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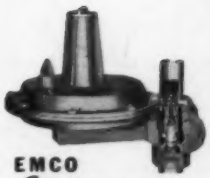

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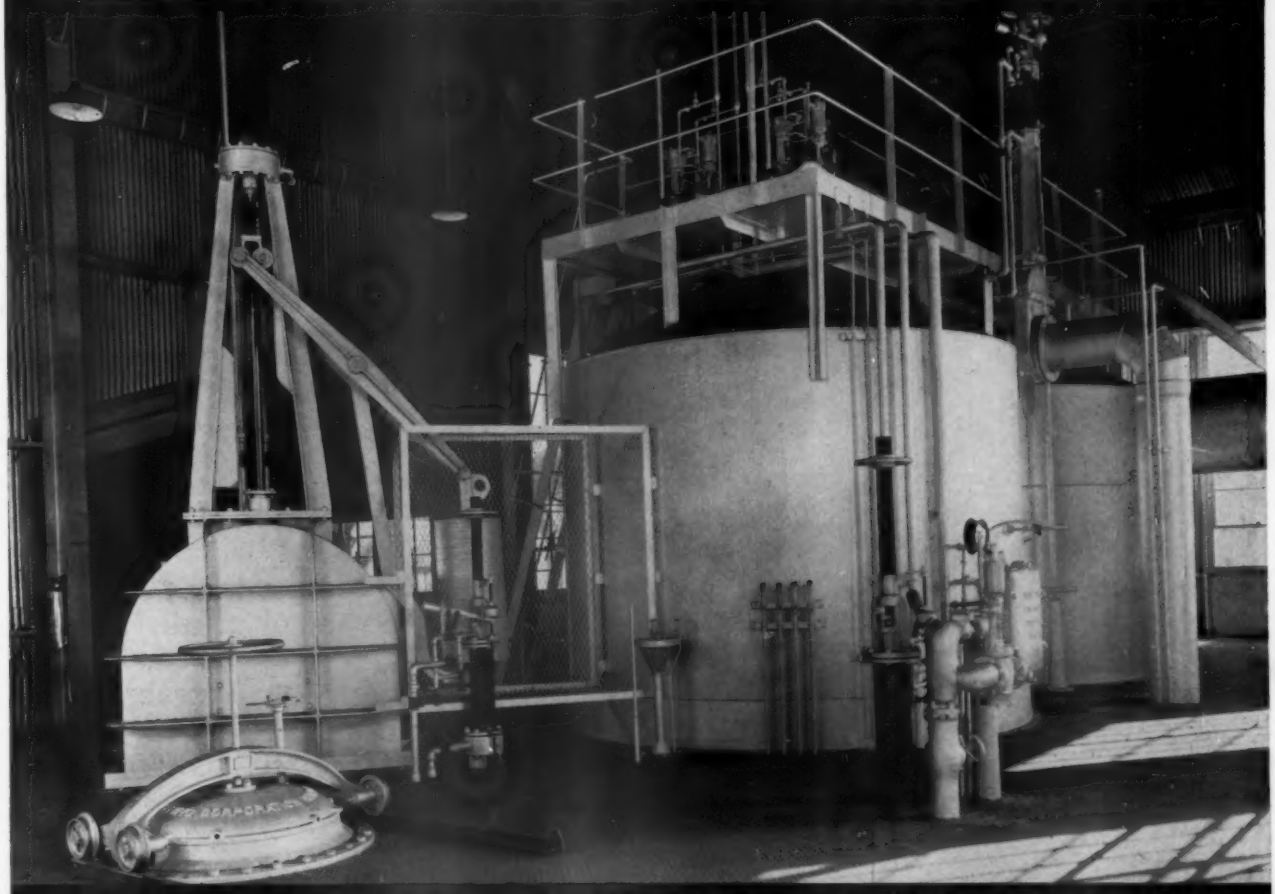

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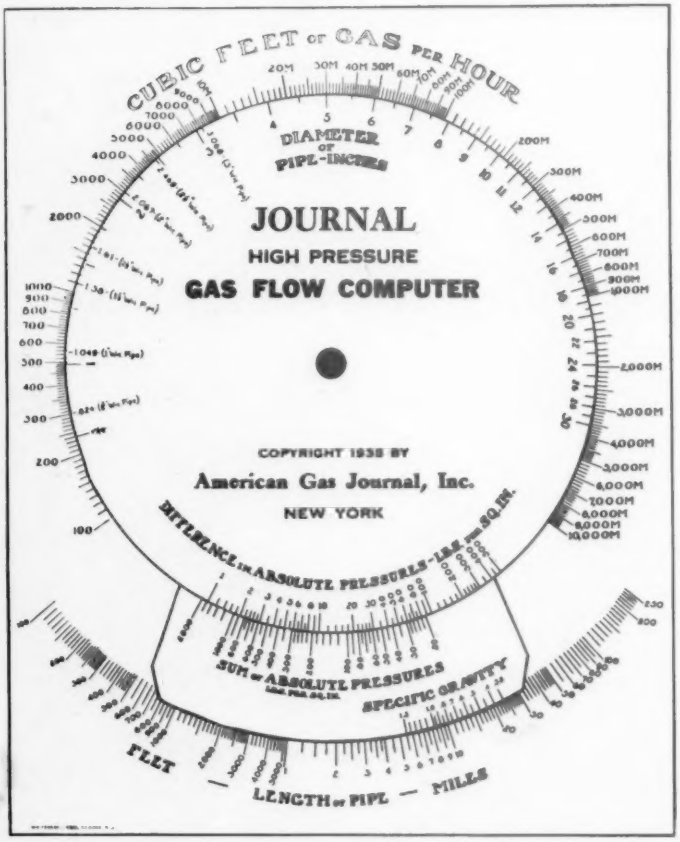

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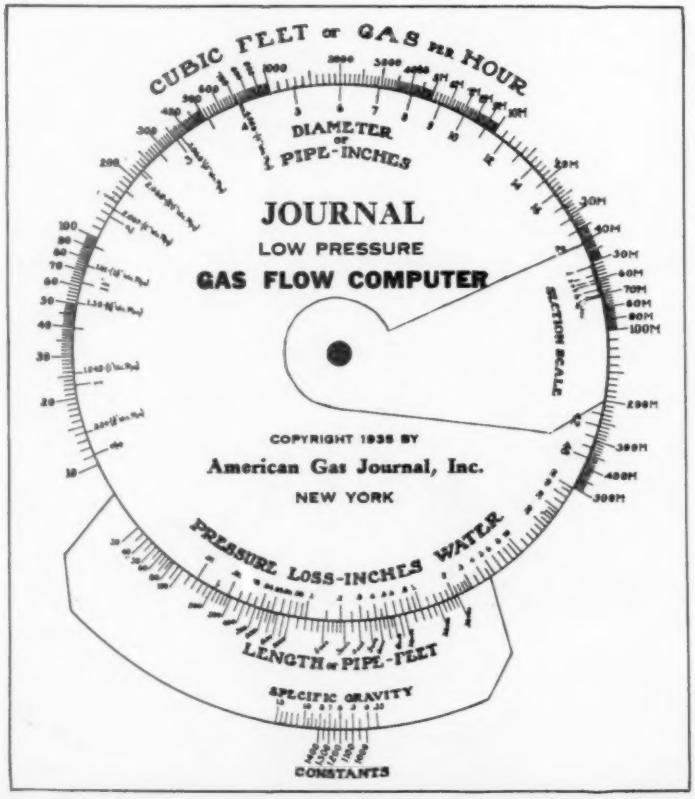

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VOLUME 148
NUMBER 6

AMERICAN GAS JOURNAL

WHOLE
NUMBER 3774

ESTABLISHED 1859

JUNE, 1938

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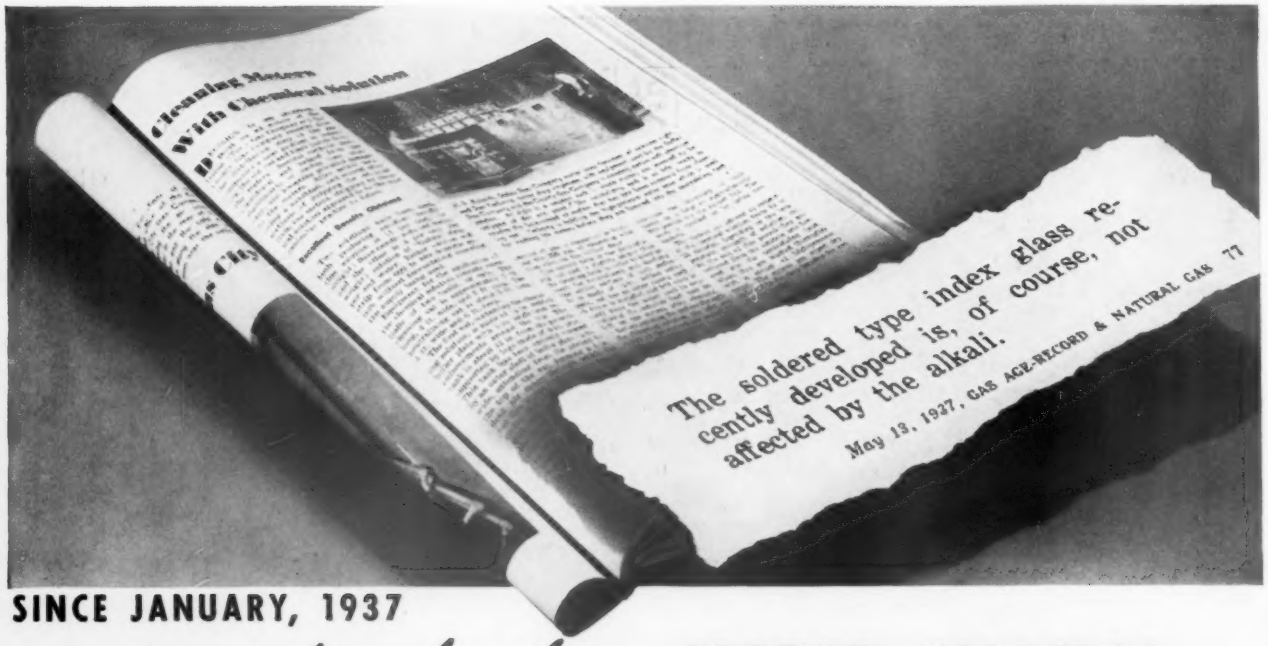
PUBLISHED MONTHLY BY
AMERICAN GAS JOURNAL, Inc.
53 Park Place, New York

S. G. KRAKE, *President and Treasurer*
M. E. KELLEHER, *Secretary*
A. I. PHILLIPS, *Editorial Director*
H. T. MATTHEW, *Business Manager*
THOMAS MORGAN, *Western Representative*
168 N. Michigan Ave.
Chicago, Ill.

Copyright 1938, American Gas Journal, Inc.

Subscription $2.00 per year U.S.A.; $3.00 Canada; $4.00 Foreign. Single copies, 25 cts.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AMERICAN
GAS JOURNAL

VOLUME 148
No. 6

Pipe Corrosion & Coatings

Types of Coatings—Cement

Part 24

By Erick Larson

This series of articles is now approaching a conclusion. A complete revision of all previous installments is being made to bring the matter up to date. With much additional unpublished data the entire series will be available in book form in the early Fall.

History

A SHEET-IRON pipe which had been encased in mortar and buried in 1856 was exposed in Elizabeth, New Jersey in 1934. This pipe was described by Mr. F. A. Engel as in excellent condition although in the same type of soil, bare steel services had a comparatively short life. The mortar in this case served to prevent contact between the soil and metal although the bond was not always sufficient to exclude moisture from the pipe surface.

There have been many experiments with mortar and cement coatings during the present century. The majority of these trials have been under severe corrosive conditions and with varying degrees of success. In average conditions a cement coating will provide a lasting protection. Important considerations are the high cost of cement coatings and the fact that considerable of the cement coated pipe can not be reclaimed should abandonment be necessary.

Fig. 1 Cement coated pipe laid in 1856 in good condition after more than 75 years of service.

The original mortar applications were trowelled onto the pipe. Later the pipe was blocked above the trench bottom and mortar or concrete placed on all sides. Forms were then used to secure thinner layers. As early as 1914, two miles of 6" pipe were cement coated, application being by means of cement guns. Reinforcing was the next advancement, progress being from an ordinary fence wire wrapped around, but not in contact with the pipe, to especially designed circumferential and some longitudinal reinforcing. The latest development has been to extrude the sand-cement mix under high pressure between a form and the pipe which results in a dense mixture.

Definitions

A neat cement is a mixture of cement and water. A mortar is a mixture of cement, sand and water. A concrete combines cement, sand, gravel or crushed stone and water. All three mixtures have been used as a corrosion protection and shield.

The term coating is used for convenience although good practice has been generally accepted to mean the use of cement coatings as shields. A waterproofing agent is placed between the pipe and the cement.

Availability

Cements are available in quantity but are restricted in use by the practical difficulties of application and cost.

Curing

A practical difficulty in application is to secure the proper interval for curing before the mortar or concrete is subjected to destructive conditions. The trench can not be backfilled until the material has attained sufficient strength to retain its bond, and to resist break-

age. Forms are retained for at least 24 hours when using ordinary cement. The time depends upon the rate at which the cement attains sufficient strength to resist the forces to which it is subjected in laying. The advice of the company manufacturing the cement is desirable as cements vary in their curing periods.

Protecting against injury by an outer shield so that

Fig. 2 Applying cement coating to a 10″ pipe. Note side forms. Pipe is suspended by wire from pipes spanning the trench. When pipe is near one side trench wall may be used as one form. Top is applied by troweling.

backfilling may immediately follow the application of the coating is essential if time is important but the effectiveness of such protection is open to question and increases the cost. If allowed to obtain its initial set, concrete will cure beneath water as the change is chemical rather than a matter of dehydration.

The use of cements attaining full strength rapidly has facilitated securing the best results with cement but even then 24 hours of curing is desirable.

Physical Resistance

The hardness attained by mortar or concrete coatings results in their being one of the most effective shields for a coating. Soil stresses are not of a sufficient intensity to affect a cement but other forces such as bending of the pipe or vibration may gradually produce craze cracks and some of these will deepen. Craze cracks are those which are visible only by minute examination of the cement surface. The thinner coats are more liable to such action than those placed by forms. The more recent developments of excrusion or wrapping application, both of which employ vibrators, have added to the strength of the cement coating and improved resistance to physical forces. Proper selection of materials, mixing and application of cement coatings will provide an excellent shield.

After proper curing a cement coating provides excellent protection against the usual conditions experienced when transporting and installing pipe. The cement coatings applied by the superior methods developed in recent years will provide more protection during transportation and installation than practically any other type of shield. It is however subject to breakage when forcibly struck by sharp edged instruments or material.

Temperature

Temperature of the pipe must be controlled to properly apply and cure cement coatings. The pipe should not be below 35 degrees F. In cold weather the ingredients should be heated before mixing. After application the coated pipe should be protected against freezing or excessive heat. If the atmospheric temperature is above 70-80 degrees F., the surface of the cement coating is usually kept moist. Covering the surface with bags and keeping the bags wet is an effective means. The coating is protected from direct rays of the sun to prevent dehydration of part of the surface.

When pipe lines are called upon to convey hot materials the concrete may crack. Experience has indicated that temperatures in excess of 100 to 120 degrees F. have materially lessened the life of pipe coated with cement compared with adjacent lines which were subjected only to ground temperatures.

Precoated cement shielded pipe which is to be gas welded in the field requires a cut back of one foot on pipe up to 2″ diameter and 18″ on larger sizes. The conductance of too great a heat to the cement coating may cause a rupture of the bond, undetectable by observation but sufficient to lessen the value. Electric welding does not result in heat being distributed as far from the joint as gas welding and therefore the cut backs may be shortened by at least 25%.

The pipe is protected from direct rays of the sun when the pipe temperature exceeds 100 degrees F. when directly exposed. The results are best when the difference in temperature between the cement coating being applied and the pipe are nearly equal.

Bond

A cement coating provides a fair bond with metal surfaces. Although the bond is usually not of the value of the better grades of enamel it is sufficient to be

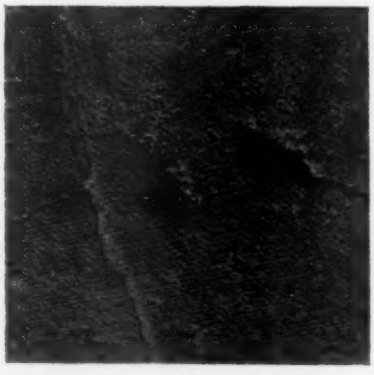

Fig. 3 Effect of sulphate soils on cement coating.

adequate for meeting any stresses caused by soil stress. The vibrating of the pipe or cement during application improves the bond as the pressure forces the cement coating uniformly against the pipe surface.

When forms are used or the trench itself is used as a form every precaution is taken to thoroughly force the cement coating onto the pipe surface.

The value of cement coatings as shields has been mentioned. Characteristics of a cement coating such as porosity, brittleness, etc. are not as valuable for corro-

sion protection as other coatings. Therefore, many apply a waterproofing material beneath the cement coat and consider the cement portion as a shield.

To facilitate placing without forms a comparatively dry mix is used. Such a mix is more difficult to bond to a pipe than one with just a slight excess of water. As in all types of application the added cost of application should be a subsidiary consideration as compared to the perfection of the finished product.

Thickness

The minimum thickness of a cement coating is usually ¼ inch. On pipe up to 2 or 3 inches in diameter and having a water proofing compound applied before the cement coating, a thickness of ¼" is satisfactory in many conditions. The thickness is gradually increased up to ½" on pipe 8" or larger in diameter.

When the coating is applied by the use of wood forms or merely placed around a pipe in the trench a minimum thickness of 1½" is advisable as uniformity of thickness is difficult to secure and the excessive thickness will provide a minimum over practically the whole surface.

There is no maximum limit of thickness from a corrosion viewpoint. Any thicknesses above the minimum adds to the cost and therefore, establishing only a reasonable tolerance above the minimum, provides the most economy.

Unusually severe corrosive conditions have been experienced in swampy lands in southern Louisiana and Texas. The application of a cement shield 2½" thick has been found to provide the required protection.

Soil Stress

The actual hardness of cement coatings provides all the resistance necessary for soil stress. The cement

Fig. 4 Troweling a cement coating on a service line.

coating can not withstand installation or soil stresses until it has obtained at least one-half of its total strength. Regular cements of the slow curing variety should be cured for six days and the rapid curing types at least 12 hours.

Porosity

Mortars and concretes are ordinarily porous. Methods and materials have been developed to decrease the porosity and for many purposes such as thick structural walls a fair degree of success has been attained. Considerable development is necessary to attain the same degree of success on such thin walls as are used for pipe coating. Considering the present state of development of cement coatings it is not desirable to consider them as non-porous. In dry soils and with a thick cement coating the absorption does not proceed to the extent that penetration of the coating occurs. Absorption and evaporation proceed intermittently with evaporation occurring for longer periods than absorption. In such conditions, although the soil may be particularly corrosive to bare metals, cement coatings without a waterproofing layer may exclude moisture from the metal surface and thereby may be classed as effective protection.

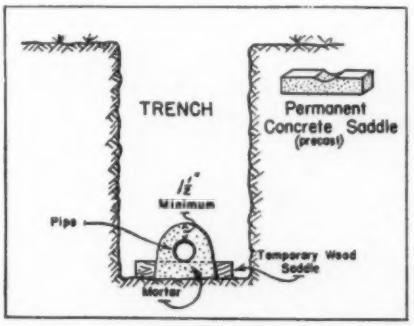

Fig. 5 Troweled cement coating. Note method of supporting pipe. Precast concrete saddle is preferable as it may remain in place.

The least rupture of the cement coating surface such as from craze cracks will lessen the corrosion protection effectiveness. Craze or other cracks would have the effect of lessening the thickness. Another view is that such craze cracks, which gradually deepen, allow a more rapid absorption and the evaporation cycle may not occur sufficiently soon to prevent moisture reaching the metal surface.

The porosity of cement coatings has been considerably decreased by improvement in the density secured by vibration during application.

Dielectric Strength

Cement coatings have insufficient permanent dielectric strength to be classed as effective for pipe coatings without being supplemented by an insulator. Cement coatings have been found temporarily resistant to stray current electrolysis in some English tests. Absorption of water decreases the dielectric strength. Electrolysis of all types will occur through a continuous cement coating.

The results of a galvanic cell action beneath the cement coating may be a cracking of the coating. The products of corrosion are more voluminous than the original metal. The swelling will raise and crack the cement.

Toxic Properties

Cement coatings do not require any toxic properties as the inherent hardness makes penetration by vegetable or animal life impossible. However, should a small crack occur a root may follow the fissure and as the root increases in size it will increase the size of the crack.

Effect on Other Coatings

In general a cement coating does not affect other

coatings. The cement coatings however will absorb a petrolatum but the petrolatum usually will not penetrate the full thickness. The slight absorption would not ordinarily decrease the effectiveness of a petrolatum coating unless that coating had become or was originally placed so thinly that an ineffective thickness remained between the pipe surface and the cement coating.

A cement coating over an asphalt emulsion may retain the necessary moisture in the asphalt in a wet soil. In a dry soil moisture from the asphalt emulsion would be withdrawn by the cement during airing or by absorption subsequent to curing. The period of protection afforded by asphalt enamels shielded with cement may be considerably extended by the use of a cement

Fig. 6 Forming concrete coating with use of sideboards only. Pipe supported on blocks.

shield of sufficient thickness. Where stray current electrolysis is prevalent the period may not be extended much beyond a non-shielded asphalt emulsion.

Effect of Freezing

Dry cement coatings are not materially affected by alternate freezing and thawing. Should the cement be partially or wholly saturated the action of freezing will cause craze cracks to form on the surface and deepen with each repetition. Cement coatings have provided effective protection over an 80 year period in a fairly dry soil although subjected to frost each year. The difficulty of knowing the extent to which saturation will occur over the full length of a main which it is proposed to shield with a cement coating is one important reason for its infrequent use.

Proportions

A plain cement-sand mixture in the proportions of 1 of cement and 2 of sand by volume is practically a minimum. Success has been attained with thin coatings of 1:3 proportions. A higher water ratio must be used with a neat cement than with mortars. Higher water ratios are necessary when application is made in thin layers by the wrapping method to improve workability. Excess liquidity with other than the wrapping method causes added difficulties of application and increases the cost.

A cement-sand mixture of 1 to 3 proportions has been effectively used by one company for a number of years. The mixture is applied by a combination of forms and cement guns.

The use of thick layers, meaning 2 inches or more allows the use of concrete. The mixtures range from 1:2:4 to 1:3:6. The sequence is cement, sand and gravel or crushed stone. For special purposes such as providing both a shield and weight to keep a pipe beneath bodies of water submerged it is not ordinarily desirable to use a less proportion than 1:3:6 as the concrete is more liable to deterioration.

Lime is sometimes mixed with the cement in proportions as high as 2 parts by volume of hydrated lime to one of cement and six parts of sand. Lime decreases the strength and therefore is used less in mildly acid soils.

Chemical Resistance

Cement coatings have been found subject to deterioration when exposed to salt water conditions. Thickness and proportions of the mix would undoubtedly effect the protective period provided by a shield. Experience with salt water conditions has been such as to advise avoiding the use of cement shields in such conditions. However, the denser cement coatings offer possibilities. The cement coatings have deteriorated rather slowly in salt water, it being estimated that at least ten years protection was afforded by the cement shield.

The salt water in which the above life of cement coatings was experienced may have been contaminated with sulphur compounds. Cement coatings have been found to deteriorate rapidly in soils or water containing sulphur compounds. Before using cement shields it is advisable to determine the nature of sulphur compounds in the soil.

A possible solution to the difficulty with acid soils caused by sulphur or other compounds may be the use of lime in the cement mixture. The curing requires a greater length of time when lime is included. While cement is alkaline the addition of lime increases the power of the shield to neutralize acids. The idea of the autogenous healing of cracks is employed in dams by the use of sulphate resisting cements. The volume of the cement in dams creates a different condition than the comparatively thin layers on a pipe. The value to be placed on autogenous healing is a question which has not been completely substantiated to date.

Application of Cement Coatings

Pipe Preparation

Cement coatings are usually applied as shields. Where the cement is also considered the water-proofing agent, preparation of the pipe surface should follow the general specifications established for cleaning

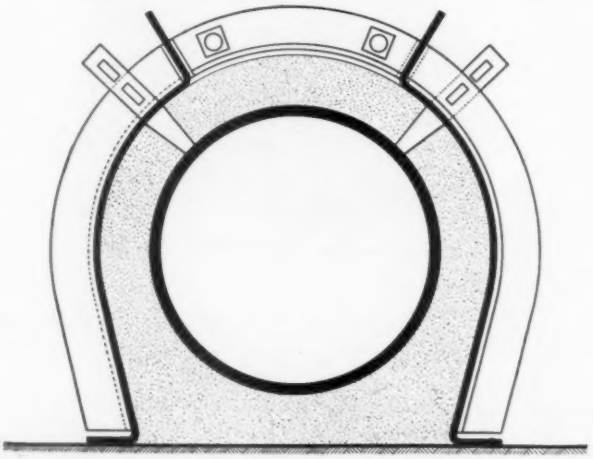

Fig. 7 A modern type of portable steel forms for applying concrete coating. Precast blocks may be used in place of the steel wedges.

pipe previous to the application of a coating. A slight dampness of the pipe surface would not be detrimental but all oil film must be removed. The thoroughness of the pipe surface cleaning need not be as intense as for enamels but there is added insurance of a proper bond if the usual practice is adapted for cement coatings.

Cement Mixing

The mixture is preferably mechanically mixed. If hand mixing is used the operation is continued until there are no noticeable lumps or unmixed material. A mechanical mixer is run for at least one minute for a comparatively wet mixture and 1½ minutes for a dry mixture. The cement mixture is applied immediately following mixing as unsatisfactory results would follow placing a cement which had attained an initial set.

Materials

The cement used may be of any standard brand. Special cements have been tried. When used such special cements should be mixed and applied strictly according to a manufacturer's special specifications. The

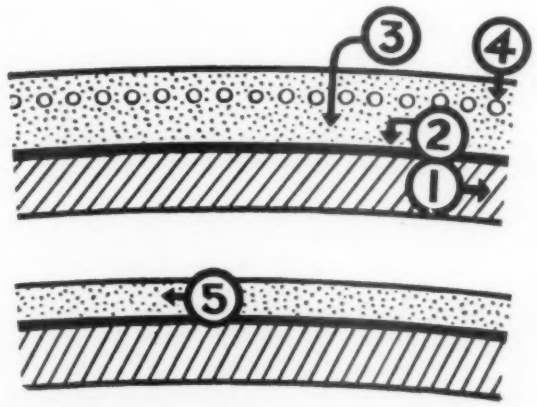

Fig. 8 Cement coatings. 1. Wall of Pipe; 2. Water-proofing material; 3. Cement coating; 4. Wire mesh reinforcing used when cement coating exceeds ½" thickness; 5. Cement coating on smaller diameter pipe, thickness ¼" or more.

tendency is to use rapid setting cements. Some rapid setting cements develop high heats during the curing period. Special care must be taken to avoid undue concentration of the heat. This is accomplished by keeping the surface moist and protecting from the direct rays of the sun. The ordinary type of cement has been developed so as to provide rapid attainment of strength without excessive heat and is therefore preferable to the high heating type. The cements attaining 80% or more of full strength within 24 hours have sometimes been termed rapid setting. The time in which the initial set occurs in both types does not materially differ. The term therefore is apt to mislead field crews to believe that backfilling may proceed more rapidly with rapid strength than other types. It is desirable even with cements attaining full strength rapidly to allow at least 12 hours before backfilling.

The sand used preferably possesses the characteristics considered desirable for the better grades of concrete. Sharp, clean, fine sand containing no foreign materials especially of a vegetable nature is necessary to secure the desired strength.

The gravel or small stone used when thick sections of cement are placed around the pipe should also satisfy the same requirements as the sand. Segregation is minimized by thorough mixing. The use of gravel or stone that will pass a one-inch screen is desirable when the thinnest section of the cement coating is two inches or less.

The water used should also be free of vegetable matter and not contain sulphates or other chemicals in quantities that will be harmful to the cement. Water which is secured from city drinking supplies can be used without question. Care should be exercised when the water is secured from shallow driven wells or surface waters. Waters in swamps or ponds fed from swamps are apt to contain considerable vegetable matter or dissolved hydrogen sulphide.

Moulded Application

The simplest method consists of making a stiff mixture which can be moulded around smaller diameter pipes without flowing by gravity before the initial set has occurred. Two inch pipe is about the largest diameter it is possible to coat by such a procedure.

Supports

The method used to keep the pipe the proper distance above the trench bottom during setting of the cement is vitally important. Two general methods are used. One consists of a support placed on the trench bottom and the thickness desired in the completed coating. The second method is suspension.

The original cement coated lines were supported on wood blocks followed by others employing bricks and finally precast concrete blocks. Failure of several lines using wood blocks and bricks was due to moisture penetration at the supports. If supports are to be used a narrow slightly grooved precast concrete block may be used. A narrow support offers less obstruction to the thorough tamping and troweling of the cement into place and being of the same material a homogeneous structure is secured. The grooving of the precast block to conform exactly to the contour of the pipe eliminates the need to force cement into a small space such as would occur were a flat block used.

For small pipe, two to three inches in diameter a 1" width of the precast support is sufficient. Eight and twelve inch mains have been successfully supported on blocks 2" in width.

Wood Forms

Forms were adapted as an economic measure as filling the whole trench with concrete would have resulted in a prohibitive cost. A difficulty with forms has been to uniformly distribute the cement around the pipe especially beneath the pipe. On large pipe, shovels, spades, grass edge cutters or home made tampers have been worked up and down on both sides of the pipe to force the mixture beneath the pipe. This procedure follows usual cement practice. A slight modification is desirable by bringing the top of the tamp toward the tamper so that the bottom edge will be underneath the pipe rather than only on the side. Care is exercised not to scrape off any waterproofing material which has been applied to the pipe.

The usual and preferable practice with side forms is to tie the tops together with cleats or especially constructed means to prevent the side board moving. Any movement may release part of the coating or break the bond. The movement of a side board may cause the thickness of the coating to become less than desirable. The bottom of the board or boards is held in place by wedging placed against the trench side or by backfilling.

The use of wooden bottom forms was tried to avoid unequal thicknesses. While some improvement in thickness was evident the gradual and nonuniform deterioration of the wooden bottom form allowed unequal settlement of the pipe causing circumferential cracks. The use of circumferential reinforcing to minimize longitudinal cracking has usually resulted in the circumferential cracks occurring at their location. The elimination of bottom wood forms or blocking tends to further eliminate cracking.

Photo Courtesy Wailes-Dove-Hermiston

Fig. 9 12" Cem-wrap steel gas line transported from San Francisco to Los Angeles. No cracking of cement mortar occurred during transportation or laying.

Steel Forms

A modern method is the use of portable steel forms. The forms are partially rounded to conform to the contour of the pipe. Considerable cement coating is saved by this method which offsets the higher cost of the forms. Erection of the forms is more rapidly accomplished than with wood side boards. The movable steel forms have been carefully designed and therefore a more uniform thickness of material is secured as the pipe is centered without the personal element being of importance. The steel wedges maintaining the proper spacing may be removed before pouring has been completed and there is then no space to be later filled. The pipe is raised above the bottom by wire fastened to the clamps holding the forms in place. Some trouble has been experienced with cracking of the concrete at the location of the wire and precast blocks have been substituted in some places.

Steel forms were used in 1919 on an 8" line run through salt marsh and city street conditions. The form designed provided only 1" of cement coating thickness. Parts of the oil line are still in service (1938). The unusually thin section indicates the confidence placed in the forms. Previous experience with wood forms had indicated that it was not unusual to find a 5" thickness on top of a pipe and practically none on the bottom.

When steel forms are used either wood forms or the cement coating troweled onto chicken wire are used on bends or fittings. The method of applying with the use of chicken wire or its equivalent is first a thin coat is spread over the first wire reinforcing then repeated applications of wire and cement until the desired thickness has been built up. The wire is similar to metal lath in house construction.

Cracking of the concrete longitudinally at the sides and top have been experienced. In unstable ground conditions such as swamp land, fills, etc. circumferential reinforcing has been used to overcome the cracking. Some have placed the reinforcing before and others immediately following the pouring of the cement coating.

Wrapping

A desire to eliminate forms resulted in the troweling of neat cements onto cheesecloth and spirally wrapping the pipe. Coatings of only 3/16" thickness containing four layers of cheesecloth were applied to 8" pipe in this manner. An advantage is the application of the coating above the trench and by using wide band slings no material injury to the coating resulted although the pipe was lowered into the trench soon after applying the coating.

Cement Wrapping Machine

The cheesecloth method has since been developed into a mechanical operation. By the use of a rather dry mix and the employment of high frequency vibration a shield of greater density and strength is secured than is possible with other methods. The increased density decreases the absorption and adds to the waterproofing qualities of the protection. The cement coating is applied in thin sections until the desired thickness is secured. The mechanical equipment is installed at centralized pipe coating stations or at pipe mills.

Cement Gun

Two miles of 6" pipe were coated by cement applied with a cement gun during 1914. Various methods of application were tried. The method then adopted as a standard was to lay the pipe on one inch concrete blocks which in turn were supported on a board placed along the trench bottom. The cement mixture was shot under the pipe and prevented from filling the whole trench by forms. The forms were extended only sufficiently high to prevent movement of the cement mixture mounded above the pipe to the desired thickness of ¾".

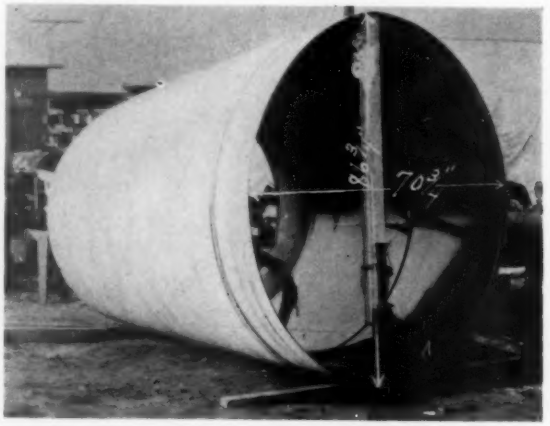

Photo Courtesy Wailes-Dove-Hermiston

Fig. 10 78" Cem-wrap steel pipe distorted to 86¾" on one axis and 70¾" on the other axis. No cracking of cement mortar occurred. This severe test on such large pipe assures satisfaction with smaller and stiffer oil and gas pipe.

Skill Required

There are available more men who have had experience mixing and applying concrete than are sufficiently skilled to apply other types of coatings. This factor may result in carelessness as the application of cement as a pipe coating requires more care than the average use of concrete. The mere availability of men familiar with concrete is hardly an advantage when pipe coating is to be applied.

Effect of Oil

Oil-soaked soils are not affected by crude oils or practically any of the derivatives of crude oils which are conveyed through sub-surface pipes.

Modern Rate Making Estimates

By
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MODERN courts are confronted with numerous difficulties, when deciding a gas rate controversy, as compared with controversies of many years ago. Therefore, in order that readers may accumulate dependable information on the subject, we shall discuss several late and leading higher court decisions involving interesting present day gas rate problems.

Land Valuation

It is a well established law, when estimating the value of land, and other real property, for rate making purposes, owned by a gas company, it is entitled to have its land valued at the fair market value thereof *at the time of the hearing* before the Public Service Commission. See Willcox v. Consolidated Gas Co., 212 U. S. 19. In other words, the land must be valued at its fair market value, and not on the basis of its special adaptability to the company's particular uses. See Minnesota Rate Cases, 230 U. S. 352.

Obviously, testimony of expert witnesses must be relied upon to determine with any reasonable certainty the market value of the land. Therefore, the legal question is important: Who may qualify as an expert witness?

It is important to know that an expert witness need not be an experienced real estate agent or broker.

For illustration, in one leading case (110 S. W. (2d) 756) the court said:

"We agree with the commission's report that Mr. Kinsey was qualified as an expert to testify on the value of real estate of the kind here involved. Though he was not a real estate broker, he was a civil engineer long engaged in real estate valuation work in that city, and his experience was sufficient to furnish a basis for his testimony as an expert. The following decisions amply support the commission's view: Union Elevator Co. v. K. C. Sub., 135 Mo. 353; Schrodt v. City, 109 Mo. App. 627; St. Louis v. Hoyt, 63 S. W. (2d) 214."

Valuation Limited

Various courts have held that in a legal proceeding to determine the value of a gas company's property for rate-making purposes, land or real property which is devoted to the generation of electricity, to merchandising, or which is leased or idle, should be rejected by the Public Service Commission as not useful in the gas business, and, therefore, not an element of valuation for ratemaking purposes.

For example, in City of St. Louis v. Public Service Commission, 110 S. W. (2d) 749, it was disclosed that when determining what part of the buildings and land of a gas company should be excluded along with superseded machinery, the estimator for the commission calculated the ratio of the area occupied by the rejected machinery in consideration of the number of square feet of floor space in the building housing such machinery and deducted that percentage from the value of the building. With reference to the land on which the building stood, the estimator took the number of square feet in that part of the building classified as nonused, and subtracted the value thereof (at the average price per square foot for the land) from the value of the whole tract. The Public Service Commission criticized this method of allocating the land, saying it withdrew from the value of the whole tract only the value of the space actually occupied by the rejected machinery, and ignored the fact that the whole tract was subservient to the building and the nonused as well as the used machinery thereon. The commission held that the proportion which the unused portion of the building bore to the used portion should be applied also to the whole underlying tract of land and that a like percentage should be deducted from the value of the land.

The counsel for the gas company vigorously assails the method, calling it a "pock mark theory," which would result in eliminating disconnected bits of land scatteringly over the premises. However, the higher court upheld the Public Service Commission's decision, saying:

"The question is not necessarily one of physically severing and withdrawing property, even though the whole of it may have been wisely bought in the first instance. It is solely a question of valuing the property used and useful in the gas business for rate-making purposes. And it is obvious that a utility cannot maintain equipment of comparatively small or no useful value on premises unnecessarily large and valuable and demand a return upon the whole. If undissevered parts become useless, the legitimate service value of the entire tract is necessarily affected."

It is interesting to know this court explained further that it does not always follow that, because a machine has become obsolete, the space it occupies also becomes useless. The court said that space may still be reasonably and proximately useful in the operation of other needed machinery on the premises.

Valuation of Mains

Generally speaking, the gas mains throughout a city constitutes a third of all the company's constructed property. Usually there is no substantial disagreement as to the unit cost of the pipe and materials entering into their construction, but differences of opinion arise chiefly over questions: (1) As to how much of the excavation work for their installation could be done with trenching machines and how much would have to be done by hand labor; (2) as to the necessity and expense of excavating "bell holes," these being enlargements of the trenches at the pipe joints to provide the room for caulking the joints; (3) as to the amount of hand excavating a laborer reasonably could do in a nine-hour day; (4) as to the expense of laying and caulking the mains; (5) and touching the proper allowance for direct overheads on labor and materials.

Of course, the final estimation, satisfactory to both the gas company officials and the Public Service Commission, is difficult to accomplish but it must be arrived at by reference to varied testimony.

On the man-hour performance in hand excavation one company expert estimated 3.4 cubic yards per man per nine-hour day, the other 6 yards, the commission's engineers 4 yards, and the city's expert 8.8 yards. The commission's report allowed 5 cubic yards per man per nine-hour day, which is a very good average under ordinary excavation conditions.

Naturally, the actual cost of laying mains cannot always be used to estimate the reproduction cost. This is true because while almost all of the gas mains and service pipes originally were laid in streets which were paved at the time of the installation, yet in many instances the streets were not paved when the original installation was made.

For illustration, in Des Moines Gas Co. v. Des Moines, 238 U. S. 153, it was disclosed that the streets were unpaved when the gas mains were put in, but had been paved thereafter. This court held nothing could be allowed in the appraisal of the reproduction cost for a theoretical cutting and replacement of the paving.

On the other hand, many courts have held that the present reproduction costs may to an extent be based upon the original installation cost.

For example, in Brooklyn Borough Gas Co. v. Prendergast (D. C.) 16 F. (2d) 615, 629, the allowance for old paving work actually done was held to be the present-day reconstruction cost. Also, in Arkansaw Water Co. v. City of Little Rock, P. U. R. 1924 C, 73, 100, and St. Joseph v. St. Joseph City Water Co. (case No. 6851, p. 54, Aug. 25, 1933), the courts held that the present reproduction cost of mains may be based upon the original installation, if the streets were paved when the mains were originally installed, and the difference in labor and material costs is fairly considered. Obviously the original cost of cutting and replacing pavement in the laying of mains and services is not always a fair measure of the reproduction cost years later, because the prices of material, the cost of labor, and the conditions of work have changed.

Classifying Equipment

In determining how much of the machinery should be classified as used and useful, it is necessary to consider three things: (1) What the maximum day's consumption of gas would be for a reasonable period in the future; (2) what machinery is fit for use; (3) and the capacity of the available machinery.

In approaching these questions it must be recognized that in furnishing gas to the public for lighting, cooking, heating, and other purposes the company is duty bound to maintain at all times, even on the shortest and coldest days of winter, without notice, a supply of gas adequate to serve consumer's needs, convenience, comfort, health, and safety, regardless of whether it could obtain natural gas at the time, and notwithstanding the amount of machinery necessary at such times of peak demand would be more than sufficient to meet the average or even the average winter demand.

In other words, some of the machinery is needed only for stand-by and emergency reserve, as in case of a break-down, stoppage for repairs or maintenance, a failure of the natural gas supply, or unusually cold weather.

On the matter of anticipated gas consumption, the Public Service Commission usually limits itself to an estimate of the maximum day's demand for manufactured gas which the company would experience in the present year if its supply of natural gas temporarily failed, and fix the amount at a reasonable quantity, as based upon testimony by experts, and available records.

Depreciation

Broadly speaking, depreciation is the loss, not restored by current maintenance, which is due to all the factors causing the ultimate retirement of the property. These factors embrace wear and tear, decay, inadequacy, and obsolescence.

In ascertaining the proper percentage of depreciation, five questions seem to be involved: (1) How much had the structural property depreciated; (2) in estimating that depreciation, should we consider only wear and tear, deterioration, and, generally speaking, diminishment in value from use, or should age, obsolescence, and other factors independent of use also be considered; (3) should all the general overheads as well as the structural property be depreciated; (4) in fixing the rate base should accrued depreciation be deducted from original, historical cost, or from the current cost of reproduction new; (5) and should the cost of reproduction be reduced by the percentage of depreciation, regardless of the fact that the company has not through the years built up a depreciation reserve out of earnings large enough to offset the accrued depreciation.

Many courts have held that general overheads should be depreciated along with the property itself, because they enter into the cost of each unit making up the whole. See City of Winona v. Wisconsin-Minnesota Light, 276 F. 996, 1004; Re West St. Louis Water & Light Co., P. U. R. 1922 E, 805, 826, and authorities there cited.

The courts recognize that the object of litigating a gas rate controversy is to find or estimate the fair value of the company's property for the purpose of fixing a rate base. In doing that both the original cost of the property and the present cost of reproduction should be considered. Dayton, 292 U. S. 290; Los Angeles Gas, 289 U. S. 287. Therefore, from the fair value of the property new, as ascertained, the amount of accrued depreciation (usually estimated in percentages) is deducted.

Upward Trend

The law is well settled that in determining the value of a gas company's property the Public Service Commission is bound not only to consider prices and wages prevailing at the time of the investigation, but also to make an honest and intelligent forecast as to the probable price and wage levels during a reasonable period in the immediate future so far as discernible.

Also, when determining whether a gas company will earn a reasonable net revenue on the investment, it is necessary to forecast what the receipts and expenditures will be. Moreover, the probable increased cost of labor and materials and devaluation of the dollar must be considered.

Galvanizing

Describing the Economy and Convenience of Gas for this Operation

by

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AN industrial gas engineer enters many plants and encounters many different heating processes. Some from the fuel standpoint are highly competitive, and he must rack his brains to bring forth logical, convincing reasons why his fuel is the best. The great majority, though competitive, have at least one certain approach favorable to gas that it is his business to know and to use. A few are so improved by gas-firing that their advent gladdens the heart of every industrial engineer. In this latter group none stands out more than the process of galvanizing.

On the face of it galvanizing is a simple art—merely dipping of steel or iron articles in a bath of molten zinc. Actually there is considerably more to it than just that. Many problems beset the galvanizing shop, problems that gas fuel goes a long ways toward solving. Problems of pot life, dross loss, uniformity of coating, control of temperature are serious bread-and-butter matters to the owner.

Galvanizing is a wide-spread industry. Most cities will have at least one kettle, perhaps in a jobbing shop or perhaps as an integral part of some manufacturing process. As an indication of the importance of this subject, consider that the world production of zinc is but slightly less than that of copper and lead, the leading non-ferrous metals, and that in the United States over 42% of all the zinc used in industry goes for galvanizing (in the rest of the world the percentage is higher).

The justification for this process is found in the following, taken from Circular No. 80, U. S. Bureau of Standards, entitled "Protective Metallic Coatings for the Rustproofing of Iron and Steel."

"Protection from atmospheric corrosion may be afforded in two ways: first by mechanically excluding all moisture and other corroding agents from the iron and steel; and second, by using coatings of such a chemical nature that the covering itself is corroded in preference to the iron or steel beneath. . . . Of the metallic coatings, by far the best for general rust-proofing is zinc. The principal reason for this lies in the chemical nature of zinc. It is the only one of the commonly used metals that is electro-negative to iron . . . that is, it has a greater tendency to be oxidized than has iron. . . . The other advantages enjoyed by zinc, such as relatively low cost, the ease with which it can be applied to steel and the fact that with a little care it will solder readily."

So much for the "why" of the process. Now for the "how," the actual mechanism of galvanizing as commonly practiced. The work, iron or steel in every shape and form from castings to sheets, from barrels to wire, is first cleaned, usually by pickling in a bath of warm dilute sulphuric acid. This removes all scale and rust and prepares the surface. It is then washed to remove the acid and thoroughly dried. Lastly it is immersed for a fairly short period of time in a bath of molten zinc. This bath is contained in a kettle, so-called, generally of rectangular shape, usually not over 4 feet wide nor 4 feet deep and of a length adequate to handle the work. The kettle itself may be of wrought iron or steel, either cast or of riveted plate construction with a thickness usually of 1" to 1¼". It is not uncommon, particularly in large production shops, to use a layer of lead in the bottom of the kettle. This is molten, of course, and being considerably heavier than zinc, stays on the bottom. Its presence affords a large bank of available heat upon which the zinc can draw at times of extra heavy demand. On the surface the zinc is covered by powdered sal ammoniac which serves as a flux and also as a protection to the surface from oxidation. As the ware is removed from the bath, it is allowed to drain a moment and then dipped in a tank of water to wash off any sal ammoniac that clings to the ware.

The temperature of the galvanizing kettle will vary for the work being treated and the thickness of coat desired. The higher the temperature and the shorter the dip the thinner the coating. Heavy castings will probably be dipped at temperatures close to 840°-860° F., while wire cloth or chain may need a bath at 900° or higher so that the zinc may penetrate to every corner and yet not fill the interstices between the mesh. The usual coating applied will run from 1¼ to 3¼ ounces per square foot of surface, or an average of around 1/6 of a pound of zinc per square foot (one side only). The need of accurate control of temperature and the maintenance of as low a temperature as practical are necessary from two angles, dross formation and pot life, two essential elements to be considered at once.

Zinc dross is an alloy of zinc and iron mixed with a saturated solution of iron in zinc. It varies in analysis but averages about 95% zinc. It is quite granular, and being heavier than zinc, sinks to the bottom. From here it is removed periodically, perhaps once a week or once in two weeks, by means of a specially shaped scoop. It is then poured into molds and obtained as ingots. These go to a refiner and are processed so as to obtain the pure spelter again. The galvanizing shop receives a credit amounting to about 60-75% of the market value of pure spelter (the trade name for zinc). Since the dross loss will run anywhere from 10% to 50% of the zinc charged into the kettle, it represents a sizable item. As a matter of fact, with coke firing and its attendant high dross formation, the cost of the dross is often more than twice the cost of the fuel itself. It is the largest single item making up the cost of galvanizing other than spelter and labor. For this reason the amount of dross formed is of the utmost importance to the galvanizing shop and helps to spell the difference between profitable and unprofitable operation.

Dross is caused by the action of zinc on the walls of the kettle and on the work. This reaction is markedly increased with temperature and it is the ability of gas fuel to maintain constant temperatures without

occasionally overheating that leads to the great savings in dross formation when changing over from coke firing. As a rule this saving will run from 25 to 40%, depending on just how good the previous coke firing had been. A substantial saving is sure and almost certainly it will be enough to more than balance any differential in the relative costs of the two fuels. Gas firing is thus less expensive than any other fuel. (As compared to oil-firing there is likewise a saving in dross, a saving in pot life, and a much higher combustion efficiency due to the care that must be taken to protect the walls of the kettle from any possible contact with the oil flame).

One research department found that dross formation varied with temperature as follows:

Temperature	820°	840°	860°	880°
Relative Dross	1.0	2.15	3.13	3.15

Gas automatically controlled will hold at temperature indefinitely. Coke firing, depending on the human element and varying with draft conditions, is certain to overheat occasionally; and such overheating means a rapid rise in dross formation. Thus, our first great argument for the employment of gas fuel is its great economic advantage due to dross reduction.

Our second great argument is the increased life of galvanizing kettles that are gas-fired. This is more or less a direct corollary of the preceding. Dross is formed by dissolving the iron of the kettle. Naturally if we form less dross, we have eaten away less of the kettle, and it will stand up longer. Undoubtedly the overheating and the fluctuating temperatures contribute their share towards the comparatively short life of the coke-fired kettles. Depending on the thickness of the pot, the method of firing, the temperature and the service their life is generally from six months to a year and a half. Since a new kettle plus the labor and material of installation represents an outlay of from $500 to $800, depending on size, etc., to say nothing of the loss of production for from three to four days at the least, the importance of saving here is evident. Gas firing will easily double the life of coke fired kettles. They will last as a rule from two to four years. In the writer's own experience a 6′ x 3′ x 3′ pot, 1¼″ thick, of pressed steel construction used for jobbing, gas-fired, lasted 3 years 11 months and was followed by a kettle that ran 4 years 8 months and 18 days before replacement. In another local plant a somewhat smaller pot ran 3 years 10 months. In both of these cases the original installation was gas, so comparison is lacking; but in a third plant coke was used for a number of years with an average pot life of 9 months. We replaced this with gas some 2¾ years ago. The first kettle, of riveted steel construction, lasted 26 months, nearly 3 times as long.

Failure with gas fired pots generally occurs at the metal line and is accelerated if the combustion chamber extends to that height. For that reason it is advisable to corbel the brick setting so as to meet the pot wall just below the metal line. Failure to dross a kettle at proper intervals also shortens its life for if the dross line creeps up above the protecting brick work (see below) and heat is applied directly against it, the wall is apt to blister and deteriorate rapidly. Following the method of construction noted below together with proper drossing will mean a long life and a considerable saving to the galvanizer, and this forms our second great talking point for gas.

There are other advantages in favor of gas, such as flexibility, cleanliness, elimination of a night fireman, adaptability to automatic control, any or all of which would make gas the preferred fuel. Used in conjunction with the overwhelming economic advantages in dross saving and pot life there should be no doubt of the issue.

Method of Gas Firing

The formation of dross, aside from its economic effect, exerts a profound influence on the method of heating a galvanizing kettle. As stated previously, it falls to the bottom where it acts virtually as an insulator. If heat is applied to the underside of the kettle, it causes overheating at that spot. The tank then blisters, and soon fails. For that reason heating is done from the sides above the dross line. This leaves a rather small area for the application of heat and again favors gas fuel with its ability to generate large quantities of heat in a small combustion space.

The conventional method of firing is illustrated in Figure A. This shows the use of impact burners firing into beds of refractory material located in a space about 15″ wide between the casing and the pot itself. The refractory material becomes incandescent and furnishes a very considerable proportion of radiant heat which is reflected against the pot walls and gives heating without flame contact. This method of firing is ideal for such conditions of limited combustion space where combustion must be completed at once without flame. The burners are located at approximately the center line of the kettle so that the heating is done from the top down. This is desirable since the greatest heat loss is from the surface. Fire brick tiles are laid along the pot up to the dross line to prevent overheating due to dross as discussed above. Instead of corbelling the firebrick casing a tile is used so as to keep the combustion chamber entirely below the metal line as shown.

The flue gases are carried down into flues near the bottom and then to one end where they are usually made use of in a drier, performing the function of drying the work after it has been pickled and just before galvanizing. This drier is merely a firebrick chamber covered by a heavy steel plate on which the work is laid. After passing under this plate the flue gases are released to the atmosphere.

The impact burners are, of course, connected to automatically proportioning devices either the high or low pressure type (see article in February 1938 issue of the AMERICAN GAS JOURNAL). They are spaced on about 12″ centers along the two sides of the usual 3 or 4 foot wide kettles, and along all four sides of the occasional square kettle. The actual temperature of the combustion chamber will run from 1100° to 1400° F. giving a rate of heat transfer through the exposed pot wall of approximately 12,000 Btu per hour per square foot of surface. This limits the

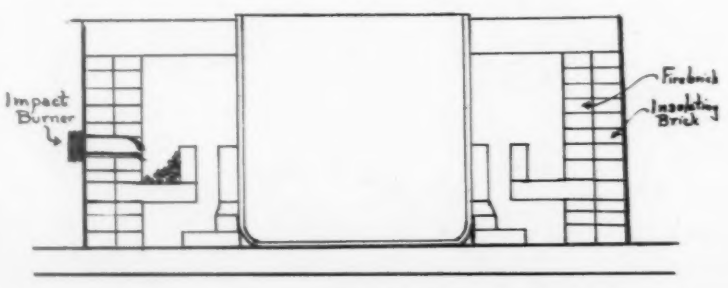
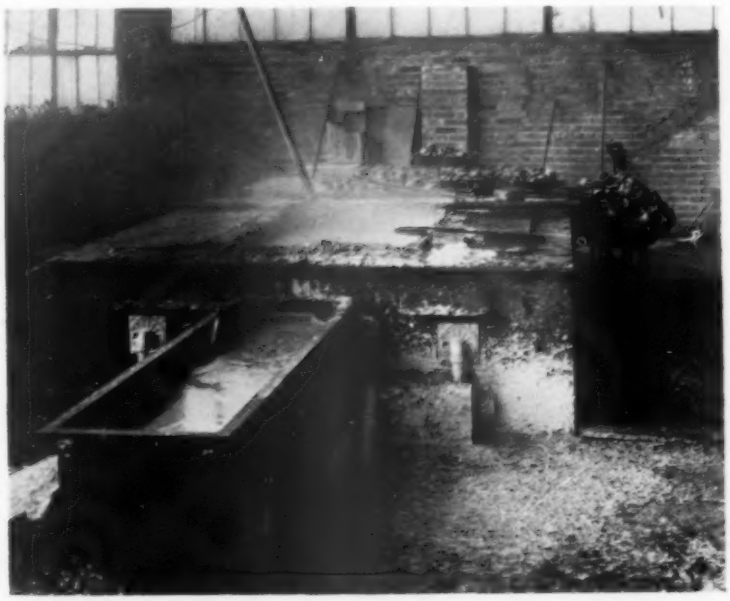


Fig. A

amount of heat that can be thrown into a kettle in a limited time and accounts for the large mass of zinc in a bath. The usual rule of thumb gauge of production is to fix the maximum output in pounds of steel galvanized per ten hour shift as equal to the weight of zinc contained in the kettle, or conversely, a kettle can handle one-tenth of its zinc content in steel treated per hour.

This method of firing is generally supplemented by atmospheric burners for holding overnight and week-ends. It is highly detrimental to the life of a kettle to allow the zinc ever to freeze completely. The fusion point is 786° F. and the usual holding temperature is about 800°F.



Galvanizing kettle 6′ x 3′ x 3′ fired by 10 impact burners as described above. This end view shows the two 6″ tile burners used for holding the kettle when not on production. The work of the type shown is lowered into the kettle at the far end, removed at the near end, and then dipped in the tank in the foreground to wash off any sal ammoniac.

When the day's work is ended, the impact burners are turned off and the atmospheric burners turned on (perhaps after two or three hours cooling down). This eliminates any possible danger from a blower breakdown or electrical failure when the plant is idle. Our practice has been to use two six-inch tile burners, one for each combustion chamber, so placed in the end walls as to fire down the length of the combustion chambers at right angles to the impact burners.

In recent years other methods of gas firing have been tried. Diffusion flame burners located in the end walls, firing the length of the kettles and back, have been used, apparently with indifferent success from the angles of both gas consumption and pot life. Immersion heating would, of course, be ideal; but unfortunately the severe action of zinc on alloy tubes so far tested practically eliminates such an application until some tube that will resist zinc is discovered and made available. The latest development has been to use radiant tube firing, locating the tubes vertically along the sides in what corresponds to the combustion chamber of the impact method just described. The tubes are 4″ in diameter, of nickel-chromium steel, placed on about 12″ centers and top fired. The tubes are not in contact with the pot walls, and excellent results have been given. (See Industrial Gas Magazine—August 1936, and July 1937). Two outstanding advantages of this method over impact firing are evident. First, kettle replacement without disturbing the setting, and second, a more compact setting, some ten inches being saved on each side. Certainly this new method merits consideration and it is to be hoped that additional data will soon be available.

Calculations

The calculation of the gas demand and consumption for a galvanizing kettle offers no difficulties. It follows the method described last month. By making one or two small assumptions it can be boiled down to a very simple formula as shown below.

The demand is made up of four elements as follows:

1. Heat to bring work to temperature.
2. Heat to melt and bring smelter to temperature.
3. Heat loss from the surface of the bath.
4. Heat loss from the walls of the setting.

(The flue loss might be considered as a fifth item but as before we will use the available heat of the gas in our calculations thus automatically correcting for this loss.)

Let us make our first assumption, i.e. that the desired galvanizing temperature is 850°F., our second that the combustion chamber will be 1,200° F., and the third that the casing will be 4½″ of firebrick plus 4½″ of insulating brick. Then the above four items become:

1. Weight of work x 110 Btu.
2. Weight of spelter x 130 Btu.
3. Surface of bath in square feet x 4,500 Btu.
4. Surface of casing in square feet x 510 Btu.

These four added together and divided by the available heat will give the gas consumption in cubic feet per hour while working. This is the correct way to proceed. The next step shown introduces two assumptions that may depart quite a little from accuracy and are only recommended when it is impossible to get the data they assume. The first of these assumptions is that the amount of spelter added will run about 15% by weight of the steel galvanized. The second is that the casing loss is about one-half that of the bath surface loss. Using these, but realizing the possible inaccuracy that may be introduced, the entire four items boil down to this equation:

$$\text{Gas consumption} = \frac{\text{Wt. of work} \times 130 + \text{Surface} \times 6750}{\text{Available heat}}$$

(The gas consumption is in cubic feet per hour while working. The weight of steel is in pounds per hour. The surface is in square feet.)

From the shape of this equation, it will be noted that the gas consumption per pound of steel varies with production per hour, the surface figure remaining constant. Low production means poor economy and vice versa. Let us take a 6′ x 3′ x 3′ kettle and a 900 Btu mixed gas. A kettle that size would hold about 20,000 pounds of zinc and theoretically handle 2,000 pounds of steel an hour. Using this figure the above equation becomes:

$$\text{Gas consumption} = \frac{2{,}000 \times 130 + 18 \times 6750}{570} =$$

668 cubic feet an hour *while working*

This gives a gas consumption of .334 cubic feet of 900 Btu gas per pound of steel, a very high efficiency. More likely the actual tonnage handled would be nearer one-half of the

Plant	Size of Kettle	Type of Work	Production Per Day	Hours/ Day	Temp. F.	Gas Cons. Cu. Ft./Lb. of work Working	Monthly	Btu Gas
1.	86 x86 x44	Sheets	100,000 lbs.	22	850	.313	.364	1,100
2.	86 x86 x56	Sheets	52,779	12	850	.320	.40	1,100
3.	84 x72 x44	Sheets	60,000	24	840	.64	.685	600
4.	27'x4 'x4 '	Tonnage	66,000	9	810	.97	1.53	550
5.	18'x42 x16	Wire	33,120	24	900	1.2	1.2	530
6.	84 x19 x48	Fittings	8,180	8½	850	1.02	1.49	530
7.	22'x36 x40	Pipe	1,100/hr.	—	850	1.0	—	570
8.	15'x36 x30	Hoop Iron	30,000	10	850	.333	.67	1,100
9.	25'x22 x34	Struc. Iron	19,500	10	—	.752	1.66	570
10.	12'x28 x32	Fittings	24,000	10	875	.542	.875	580
11.	7 'x22 x24	CI Ship Parts	3,000	9	820	1.05	—	525
12.	5 'x2 'x30	Small Castings	600/hr.	—	—	.60	—	570
13.	22'x36 x36	Jobbing	50,000	10	850	.58	1.06	580
14.	6 'x30 x48	Light pressed steel	3,893	8½	850	.715	1.66	550
15.	12'x26 x28	Fittings	27,200	8¾	860	—	.91!	530
16.	5 'x3 'x3 '	Wire Screen	5,900	24	—	1.12	1.12	550

Note:—Gas consumptions are in cubic feet of gas of the heating value given per pound of work galvanized. The first figure under the heading "Working" is the consumption while on production. The figure under "Monthly" is total monthly gas consumption divided by production and takes into account the gas used in holding the kettle above freezing (786 F.) during non-production hours.

above and the figure becomes .442 cubic feet per pound. (570 is the available heat for a 900 Btu gas at 1,300°F.)

It should be borne in mind that the kettle is probably on production only 40 or so hours out of the 168 in the week and that gas is used during the other 128 hours to keep the kettle from freezing. With a holding temperature of 800°F, the above equation when solved becomes 185 cubic feet an hour, and the weekly gas consumption for a production of 40,000 pounds, 41,380 cubic feet or 1.034 cubic feet a pound. This figure is in line with actual production records and represents average practice where no attempt is made to save gas by using insulating covers over the kettle during the non-working hours. Such covers should always be recommended as their use materially reduces the heat loss, usually about 30%. Several materials can be used. Generally the problem is to have the cover light enough to handle without difficulty. Panels of Sil-o-cel C-3 cement, small enough to carry around, make very good covers. Even as little as a sheet or two of corrugated iron thrown over the kettle will effect a saving, and should be resorted to lacking better covers.

As a summary, when talking gas fuel to a galvanizer emphasize the saving in dross and the increase in kettle life that will accompany conversion to gas. Run a survey, if his records are not complete, and determine his actual dross loss. Show him where it represents a cost double that of the coke he uses. Tell him that although the gas bill will be greater than his coke bill, he will more than save the difference in dross. Ask him how long his kettles last and what it costs to replace them (not just the pot cost but the labor and material of rebuilding the setting.) Show him where gas-fired kettles stand up two to four years and see what saving that represents. Then, give him an estimate of the cost of installing gas and get his order to take effect when the present kettle fails. Get the burners in stock and be prepared for three days of 24 hour labor to make the change-over. You will be fortunate, indeed, if you do not have to make the change during a rush in production when the kettle can not be spared a moment longer than absolutely necessary. But once gas is in and the galvanizer has checked your statements, you need never fear a competitive fuel will ever be given consideration in that shop.

Col. and Mrs. Henry L. Doherty Get Degrees at Miami

Henry L. Doherty, president and founder of Cities Service Company, and Mrs. Doherty received honorary degrees at the commencement exercises of the University of Miami, Miami Fla. The degrees were conferred by Dr. B. F. Ashe, president of the university, and Mary B. Merritt, dean of women.

HENRY L. DOHERTY

Col. Doherty, whose degree was conferred in absentia, was honored as a Doctor of Science, Mrs. Doherty received the degree of Doctor of Philosophy.

Dr. Elmer V. Hjort, professor of chemistry in the university, cited Col. Doherty as "a pioneer in the fight to prevent the waste of our great resources of natural gas and petroleum. His versatility led him into many other fields of science less well known to the public," Dr. Hjort said, "and his lively interest and co-operation in the research of others, and his moral and financial backing of their projects has been responsible for the further extension of human knowledge."

Dean Merritt praised Mrs. Doherty, who was present to receive her degree, as "the inspiration and agent in a great variety of philanthropic movements."

Mystery Chef Broadcast

Contracts have been signed with the National Broadcasting Company, McCann-Erickson, Inc., and the Mystery Chef for a continuation of the Mystery Chef radio program for the period May 31 to November 24, 1938 inclusive.

Fifty-two companies having in service 3,419,673 meters have signed up for the program for the continued six months' period. These companies are located in Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, California, Oregon, Utah and Washington. The facilities of the following NBC stations will be used to broadcast the program: WEAF, New York; WNAC, Boston; WEAN, Providence; WTAG, Worcester; WCSH, Portland; KYW, Philadelphia; WBAL, Baltimore; WGY, Schenectady; WTAM, Cleveland; KDYL, Salt Lake City; KFI, Los Angeles; KGW, Portland; KOMO, Seattle.

An Investment Analyst Surveys Our Industry

WE commend to our readers for careful study *Poor's Survey of Electric Power and Gas Utilities,* published April 29, 1938. For one thing it contains a large amount of detailed financial information for various utility companies. Of even more importance is an unusually keen analysis of the situation confronting the gas and electric industries. While we do not agree in detail with all of the conclusions, they are ably and fairly drawn.

With respect to the future of the Natural Gas Industry the survey is optimistic. "In the years ahead, basic characteristics stimulating further growth should enable the natural gas industry to surmount its rate, tax, and expense problems."

Its picture of the Manufactured Gas Industry is not so bright. "The problem of rising expenses, in which labor and tax costs play a major role, seemingly defies solution." Mr. A. M. Beebe in his able paper, appearing in this issue of the *Journal,* takes the opposite view; and our own opinion is that he is more nearly right. We believe the manufactured gas industry is on the edge of revolutionary development along lines which as yet a financial institution would hardly recognize. The real problem which most nearly defies solution is how to finance the necessary research and development, and how to amortize major obsolescence in the face of present business uncertainty and governmental restrictions and hostility. We are confident that a way will be found.

On the subject of taxation *Poor's Survey* is particularly sound. It says:

"Public utilities occupy a particularly disadvantageous position with regard to taxation, since they are under constant pressure for lower rates while, because of indirectness and ease of collections, they afford shining targets for taxation. Between 1912 and 1937 the industry's tax burden increased from $13,000,000 to more than $350,000,000, while gross revenues increased from $268,000,000 to $2,200,000,000. In the latter year, taxes consumed about 16% of gross against less than 5% in 1912. This compares with the industry's total labor cost —approximately 19% of gross revenues. Beginning Sept. 1, 1933, the Federal 3% tax on residential and commercial sales was transferred from the consumers to the companies, although the rate was reduced to 2% for 1938. There have followed similar 3% state and 3% municipal levies. Since June 1, 1937, New York State has taxed utility gross revenues 2% and allowed municipalities to collect an additional 1%—a dangerous example. Although scheduled to expire on July 1, 1938, the measure doubtless will be extended as the proceeds are ostensibly for relief purposes.

"In the meantime, customary local property taxes, which constitute the largest single tax, likewise have increased, particularly since 1934. For example, certain assessed valuations were increased more than 100% in New York City during recent years. With more Government spending indicated and relief demands urgent, greater rather than reduced taxes are forecast.

"In 1936, 15% of intercorporate dividends became subject to Federal Income taxation. To force corporate simplification, the Administration may urge further increases along these lines. However, indications are that the maximum surtax upon undistributed profits will be reduced from 27% to 2½%—a material aid for this industry as funds are needed for expansion at a time when security markets are adverse.

"One of the new tax levies which will steadily increase is that arising from the Social Security Act. For old age pensions, employers must pay the equivalent of 1% of annual pay rolls in 1937 through 1939, the rate being gradually stepped up to 3% by 1949 where it will remain. For unemployment insurance, the tax began at 1% of pay rolls in 1936 and is stepped up to 3% by 1938."

Here perhaps is the greatest problem with which all utilities,—yes, the entire nation, is faced.

As Others See Us

We present to our readers without comment of our own what our good friend, *The Gas Times,* (London) has to say editorially of Mr. Wyckoff's article, which appeared in the April, 1938, issue of the *Journal.*

Quo Vadis?

"To quote Mr. Carl B. Wyckoff, of the Public Services Company of Colorado. 'Where we are going is a highly involved question today. Most of us are at a loss to know where we are *at,* to use the vernacular of the street. About all we know is where we have been.' That is probably true of our friends in America, where conditions for the last few years have been decidedly unsettled. It is not for us to criticise, but the manual operation of the trade pumps in the country does not seem to have been very effective. Priming was a troublesome job, and when the pumps started to draw they discharged on the just and unjust alike. Of late they have taken to drawing air again and so the priming process is to be renewed. This uncertainty about the working of the trade pumps has its repercussions on the nerves of our gas friends over there: They do not know where they are from day to day. We are sorry for their lot; but even so we cannot refrain from pointing out how much better off is the gas industry over here. Our trade pumps seem to be self-acting and able to stand heavy overloads. The gas industry over here is on a solid foundation and can lay its plans ahead with some assurance. But there is a truth in Mr. Wyckoff's summing up that is of universal application. He says: 'Pulling door bells . . . does not help to build up one's morale, but as sales cannot be made without contacts, it naturally follows that the more calls the more sales.' With purchasing power over here at a high level, the morale need not suffer as it does in America at the present time, and in any case it is the fact that the more the calls the more the sales. Will our own gas industry wake up to that fact while the going is good?"

"Our Job Is a Selling Job"

Merchandising Featured in Papers at Natural Gas Department Meeting

THIS was the theme of the Annual Convention of the Natural Gas Department of A. G. A. held at New Orleans, La., May 9-10-11 and 12. Monday's program was devoted to group meetings.

H. E. Meade of the New Orleans Public Service, Inc., presided over the domestic sales conference. The speakers were Streuby L. Drumm of the New Orleans Public Service Inc., "Promotion Is the Keynote to Success," and George W. Bean, A. G. A. fuel representative, Washington, "How the Washington Office Helps Promote the Sale of Gas."

Hale A. Clark of Detroit, Mich., presided over the industrial gas conference. The discussions were by L. H. Hungate, Jr., of Memphis, Tenn., "Gas Company's Place in

HALE A. CLARK
Chairman, Industrial Gas Conference Committee

Servicing Industrial and Commercial Equipment"; George M. Parker, St. Louis, Mo., "Developing Aggressiveness in Industrial and Commercial Gas Sales," and W. James Amoss of the New Orleans Public Service Inc., "Analyzing Markets for Greater Industrial and Commercial Gas Sales."

Mr. Parker's paper presented a complete industrial sales program. He stressed the importance of servicing industrial installations for various reasons. It keeps the equipment working satisfactorily and at the same time educates the operators in the proper care of the equipment.

A. L. Forbes of El Paso, Tex., presided over the transmission committee conference. B. M. Laulhere of Los Angeles spoke on "Design of Liquid Separators for Natural Gas Pipe Lines."

Production Committee Symposium

At the Production Committee Conservation Symposium, L. B. Denning, Sr., Lone Star Gas Co., Dallas, Chairman, conservation leaders of five states discussed "What Our State is Doing About Conservation." They were William G. Rankin, Louisiana; William J. Armstrong, Oklahoma; E. C. Dahlgren, Kansas; Alexander Crowell, Arkansas; V. E. Cottingham, Texas.

Other discussions on the program were by L. B. Denning, Sr., Dallas, Tex., "The Problems of Conservation;" E. O. Bennett of Ponca City, Okla., "Pressure Maintenance of Flush Production and Its Value to the Natural Gas Industry;" Hugh Stalcup, Tulsa, Okla., "What the Oil Industry Is Doing About Conservation," and Kenneth Eilerts, Bartlesville, Okla., "Flow Characteristics, Composition and Some Liquid Phase Properties of Samples from a Combination Well."

Transmission Committee

The transmission committee also held an afternoon conference.

The following topics were discussed: "Combination Dehydration and Desulphurization," by T. S. Bacon, Dallas; "Recent Developments in Gas Hydrate Study and

E. HOLLEY POE
Secretary Natural Gas Department of A.G.A.

Dew Point Apparatus," by W. M. Denton, Bartlesville; "Recent Improvements in Electric Welding on Pipe Lines," by Hal Price, Bartlesville; "A New Development in Oxy Acetylene Welding Pipe Lines," by F. C. Hutchinson, Kansas City; "Practical Application of Cathodic Protection," by R. J. Kuhn, New Orleans. The discussion will be led by Star Thayer, Houston.

Industrial Gas Sales

The industrial gas sales conference

ROBERT W. HENDEE
Chairman
General Session

held an afternoon meeting with Franklin T. Rainey, Columbus, Ohio, as chairman.

At this session the following subject was presented: "Absorption Refrigeration for Summer Air Conditioning With Gas," by W. F. Friend, New York. This paper was discussed by L. O. Vogelsang, San Antonio. "Features of Up-to-Date

Industrial Furnace Design That Help Gas Sales," by Henry M. Heyn, Toledo, Ohio; "Keeping Commercial Gas Kitchens Up to Date," Clarence H. French, New York, and W. M. Jacobs, Los Angeles.

General Sessions

General sessions started Tuesday morning. Robert W. Hendee, General Manager, Colorado Interstate Gas Co., Colorado Springs, Colo., Chairman: Mr. Hendee stated that the "job of the gas industry was a selling job." He said the gas industry should not meet competition —but make competition.

N. C. McGowen, Houston, Texas, President of American Gas Association stated that "We should further our efforts to increase future utilization of natural gas. That doesn't mean we should have the desire to sell more gas than is needed but rather all that is needed. The use of gas in engines and air-conditioning in the future has practically unlimited possibilities."

Merrill N. Davis, Bradford, Pa., president of the Association of Gas Appliance and Equipment Manufacturers, charged that gas companies have been "criminally negligent" in overlooking the domestic market for natural gas, particularly in home kitchens. Of 16,000,000 gas ranges in use throughout the country, 75 per cent of them are out of date, he said.

"In other words, 12,000,000 customers are not getting the service they should get and our competitors are stepping in and selling other fuels."

T. R. Weymouth, V. P. Columbia Gas & Elec. Co., New York, was Chairman of the afternoon session. **Mayor Alexander Forward, Managing** Director of the American Gas Association in his address stated:

"Our industry, I am glad to say, is not affected by the depression. It has been and is making steady progress. It is affected principally by mild winters, which reduce the domestic consumption. The development in the future should be far beyond the present."

Herman Russell of Rochester, N. Y., president of the Rochester Gas and Electric Company, said, discussing present economic conditions: "I do not think there can be any permanent cure by the policies this government is now following. As long as one goes into debt, everything is lovely; but some day, payment for that debt will be exacted. A government is no different from an individual. When that day comes, what?

"In my part of the country, business men are somewhat worried, though they admit that the present heavy spending program is going to have some immediate economic effect. It's all right to prime a pump, but we see a new meaning to the term now, and the question is, how long is the primer going to last?"

The Wednesday morning general session was presided over by H. C. Cooper, Pres. Hope Natural Gas Co., Pittsburgh, Pa., and was devoted to reports of various committees. Several round table luncheon conferences were held.

Domestic Sales

The Domestic Sales and Utilization Committee held a meeting in the afternoon presided over by H. E. Meade of New Orleans, Chairman; Commercial Refrigeration was discussed by Carl Conkey, Servel, Inc., New York, "Selling Heat to New Homes," by H. M. Crawford, Pacific Gas & Elec. Co., San Francisco, Calif. Miss Mildred R. Clark, Chairman Home Service Section of A. G. A., Tulsa, Okla., addressed the meeting on the subject "Home Service as an Aid to Sales."

Home Planning Luncheon Symposium was held Thursday noon, and was presided over by Herman Russell, Rochester, N. Y., Chairman.

E. H. Poe, Secretary of the Natural Gas Dept. of the American Gas Ass'n., was constantly on hand to see that the program went along smoothly.

Acid Treating of Gas Wells to Increase Production*

By

M. E. Chapman

Chemical Process Co., Inc., Tulsa, Oklahoma

THE use of acid to increase production of oil and gas wells has become a well established practice throughout the oil and gas industry. The acidizing of calcareous formations to stimulate natural gas recovery has not become nearly so widespread as the acidizing of oil wells. Acid treating of gas wells has been largely confined to portions of Kentucky, North Louisiana, the Panhandle of Texas and the Hugoton gas area of Kansas.

The principal purpose of acid treatment is to enlarge the drainage channels which lead to the well bore or to dissolve a calcareous barrier which may be blocking the ingress of flow into the drainage area of a well. Although acid may enlarge the cavity at the bottom of the well it is largely wasted unless it opens or enlarges channels leading into the well.

The treating of sandy limes has not been nearly so successful as the treating of limestones and dolomites. In sandy limes calcareous material ordinarily is present either as thin unproductive layers or as a cementing material. In the first case, acid attacks the lime only; consequently the porosity or permeability of the producing horizon is not increased. In the latter case the acid solution dissolves the cementing material which would cause the sand to slump. The effect of this action would actually restrict flow. If acid merely dissolves cementing material it will not enlarge or open drainage channels and will not appreciably aid in increasing production.

Hydrochloric acid of varying concentration is the principal agent used in treating wells. The products of the chemical action of hydrochloric acid on pure limestone and dolomite are largely water soluble residues and gas.

Hydrochloric acids react with pure limestone, i. e., calcium carbonate, to form carbon dioxide, calcium chloride and water according to the following equation:

(1) $2HCl + CaCO_3 = CaCl_2 + CO_2 + H_2O$

The reaction with dolomite is

(2) $4HCl + CaMg(CO_3) = CaCl_2 + MgCl_2 + 2CO_2 + 2H_2O$

Commercial hydrochloric acid weighs about 9.476 lbs. per gallon and contains 28% or 2,653 lbs. hydrogen chloride and 72% or 6.823 lbs. water. Water which is present in commercial hydrochloric acid does

* *Presented at Meeting of A.G.A. Natural Gas Department, New Orleans, La., May 9-12, 1938.*

not enter into the chemical reaction of hydrochloric acid and limestone. By using one gallon of commercial hydrochloric acid and applying weights of each substance in equation No. 1 the following results are obtained:

(1a) 2.653 lbs. HCl plus 6.823 lb. H_2O plus 3.64 lb. $CaCO_3$ equals 4.035 lb. $CaCl_2$ plus 1.602 lb. CO_2 plus 0.655 lb. new water plus 6.823 lb. original H_2O.

Weights involved in equation (2) are: 2.653 HCl plus 6.823 lb. H_2O plus 3.352 lb. $CaMg(CO_3)_2$ equals 1.736 lb. $MgCl_2$ plus 2.018 lb. $CaCl_2$ plus 1.602 lbs. CO_2 plus 0.655 lb. new H_2O plus 6.823 lb. original H_2O.

Calcium and magnesium chloride are readily soluble in water. At 32° F. the solubility of $CaCl_2$ in water is 59.2%. The solubility of $MgCl_2$ is 52.5%. With increase in temperature the solubility of these chlorides increases. At 140° F., which is the normal temperature at 4000 feet the solubility of $CaCl_2$ in water is 136% and of magnesium chloride is 66%. In equation 1A the weight of $CaCl_2$ is 54% of the weight of water present. In equation 2A $CaCl_2$ is 27% of water and weight of $MgCl_2$ is 23.2% of the water present, therefore water from one gallon or 28% hydrochloric acid will dissolve all chlorides produced by the reaction of limestone and dolomite. In addition to the water which is present originally in acid, it is established practice to dilute acid used in treating wells. Commonly the treating solution consists of 50% commercial hydrochloric acid and 50% water. Accordingly, there is little danger that all the chlorides formed will not be dissolved. One thousand gallons of treating solution made up of 500 gallons of commercial hydrochloric acid (18° Baumé) and 500 gallons of water will dissolve about 10 cubic feet of limestone.

However, virtually no limestone beds are pure limestone, they contain acid insoluble material such as shale, sand, chert, anhydrite, gypsum, iron and aluminum compounds and associated metal compounds. The chemical reaction of acid on calcareous formations is relatively simple; however the disposal or emitting of the residual products has become the subject of much study. Although it is important to introduce acid it is equally important to get out the resulting products.

Acid used in treating is neutralized in an exceedingly short time. Because of this feature, in order to obtain maximum results it is desirable to force the acid used in treating into the formation as rapidly as possible. After the acid has been forced into the producing formation the standard procedure now is to immediately reverse the flow of the treating fluid. During the early days of acidizing, wells were shut in for 48 to 72 hours awaiting chemical reaction. Generally, the shut-in period has been reduced and it is the usual practice now to reverse the wells within a few minutes after the acid has been displaced into the producing horizon.

As previously mentioned, sand, shale and other materials occur as partings, or are distributed through the limestone matrix. When the limestone or dolomite is dissolved by the action of acids these insoluble particles may remain to interfere with the flow. In addition to the desirable removal of the products mentioned the reversal of direction of flow, after acid has partially completed its solution work, allows the acid to work while flowing both ways. This procedure permits a dissolving action as acid is entering the formation and favors an enlarging of drainage channels upon reversal. A small amount of unspent acid can do little good if allowed to remain widely spread in the drainage area of a well. Further, there is an economical justification for this procedure, in that operators are enabled to place their wells on production much sooner.

Acid begins to neutralize immediately upon coming into contact with calcareous materials. Accordingly it is desirable to force the acid back into the producing zone of a well at a rapid rate. If acid is forced into the formation at a slow rate the first portions of the acid are neutralized and consequently a chemically inert fluid is being forced back into the drainage channels of the well. In recognition of these facts treating companies have designed high pressure, high volume pumps and are continually making improvements along mechanical lines. Although the pumps used in acid work are extremely efficient with regard to high volume and high pressure, operators generally favor the multiple pump hook-up. On large acid shots, two or more pumps are used to inject the acidulated fluid into the wells. Recently a well was treated in Young County, Texas, with 20,000 gallons of acid. This acid charge was followed with an oil load of 230 barrels. Ten pumps were connected and delivered fluid simultaneously. The over all treating time on this well for the acid and oil load was 59 minutes.

During the early days of acid treating of gas wells it was the usual procedure to use compressors. Briefly, the method used was to introduce acid into the well at the casinghead and then the acid solution was driven into the producing formation by the use of compressed air or gas. Usually considerable time was required to treat a well in this manner. The latest innovation in the treating of gas wells is to use water behind the acid as a pressure medium. Only sufficient water is placed behind the acid to balance the bottom hole pressure and thereby drive the acid into the producing formation. In following this procedure the closed in, or rock pressure, of a well is taken and the volume of water to be used as a load is thereby calculated. Water exerts a pressure of 43.4 lbs. per 100 ft. in depth.

During treating three (3) or four (4) pumping units are used. Connections are arranged so that all the pumping units will simultaneously deliver the treating solution and subsequently the water load. When wells are treated by this method a bailing or swabbing unit is stationed at the well. The bailer or swab is run following the treatment and sufficient water is taken from the top of the water column to unbalance the bottom hole pressure. Usually one pull with the swab is sufficient. The wells are then allowed to flow into the air and clear themselves of remainder of water and the spent treating solution. The rapidity of this type of treatment apparently accounts for the successful results which have been obtained.

By using this method a well was treated in the Panhandle of Texas in 23 minutes, using 5000 gallons of acid followed with a water load of 53 barrels. The well was allowed to be shut in 20 minutes awaiting chemical reaction. Before treating, the well had a rated potential of 16,900,000 cu.ft. of gas per day. After treating, the well gauged 65 million cubic feet. Samples of the spent acid solution following the treatment indicated that the acid was completely neutralized.

In summary, acid treating of gas wells produces better results if the acidulated mixture is forced into the producing formation at a rapid rate and better results are obtained if the wells are quickly reversed and the closed-in period reduced even though some unspent acid may be brought to the surface and wasted.

Combination Gas Dehydration and Desulphurization Plant

by
T. S. Bacon,
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THE natural gas industry, during its early years, paid very little attention to gas purification problems. Dry natural gas was generally found to be a satisfactory material for pipe line transmission in its raw state, if it were free of hydrogen sulphide. Oil, distillate, and water that settled out in the transmission lines were removed from the lines through drips and pipe line freeze-ups were regarded as an unavoidable evil in cold weather. Large quantities of sweet gas are still available and it is only infrequently that sour gas is desulphurized to be used for transmission by pipe line to domestic and industrial consumers. However, each year new installations are made for sweetening sour gas before this gas enters distribution systems. And each year new dehydration plants are being installed to remove water vapor from natural gas.

A recent problem of desulphurization of natural gas resulted in the design of an unusual plant for removing water vapor and hydrogen sulphide from natural gas in a single step. The Northern Natural Gas Company was taking gas from a field in Rush County, Kansas. The field pressure was in the vicinity of 900 pounds per square inch and the line pressure ranged from 350 to 450 pounds per square inch, hence water condensation in this particular line was negligible. The gas entering the line was sweet when the line was laid, but many wells in the field have since become sour, and it recently became necessary to install a desulphurization plant in this field. A survey of the available desulphurization processes was made and it was found that any known process would add appreciable quantities of water vapor to the treated gas. In fact sufficient water vapor would be added to the gas to cause condensation of water in the transmission lines leaving the desulphurization plant. The Northern Natural Gas Company had already become aware of the advantage of gas dehydration, and were installing two dehydration plants at other points on their system at that time. It was, therefore, believed imperative to install a dehydration plant after the desulphurization plant. In this particular case, the cost of dehydration would have to be added to the cost of desulphurization, as the operation of the sulphur-removal plant would make necessary the operation of the dehydration plant.

The benefits that may be derived from gas dehydration are particularly apparent on the Northern Natural Gas Company system. Also, the degree of dehydration that must be obtained for full protection is unusually high on this system, as gas is transported from the warm climate of the Texas Panhandle to the cold climate of Minnesota. The frost depth on the northern end of the system frequently drops below the pipe line depth, which requires that the dew-point of the gas in the northern end of the system be below 32° F. to prevent freeze-ups. In addition, the gas distributed in the north end of the system contains traces of hydrogen sulphide and of oxygen, and it is probable that internal corrosion of the transmission lines would occur if liquid were also present. Partial dehydration of the gas entering the system in Texas by the use of calcium chloride solution or by cooling to temperatures just above the temperatures at which hydrates form will not remove sufficient water from the gas to prevent condensation in the north end of the system under all conditions, but it is probable that the dew-point could be lowered sufficiently by the use of refrigerated calcium chloride brine.

Figure 1. Desulphurization—dehydration plant

Presented at the Meeting of Natural Gas Department, American Gas Association, New Orleans, May 9-12, 1938.

A simpler dehydration process, using diethylene glycol as the water absorbing medium, has proved to be very economical in operation and at the same time has lowered the dew-point of the gas by 40° F. or more. The Northern Natural Gas Company pioneered the commercial use of diethylene glycol for gas dehydration, and are well satisfied with the results obtained.

A study of the cost factors and chemical factors involved indicated that dehydration and desulphurization possibly could be accomplished in a single plant in the Rush County Field. The agent for hydrogen sulphide removal would be physically mixed with the agent for dehydration instead of with water as is the normal practice in desulphurization plants. The resulting liquid mixture would then be brought in contact with the gas to be purified in a conventional gas scrubber. The fouled solution leaving the scrubber would be freed of the absorbed water vapor and hydrogen sulphide by boiling in a steam-heated still, and the regenerated liquid leaving the still would be cooled and returned to the absorber.

Several possible combinations of reagents apparently could be used in such a plant. Liquids used for hydrogen sulphide absorption include soda-ash solutions, sodium phenolate solution, and various amines. Liquids used for gas dehydration include calcium chloride solution, glycerine, and diethylene glycol. Some of the advantages of diethylene glycol as a dehydration agent have already been indicated. The amines are miscible with diethylene glycol in all proportions, and also are hygroscopic, so the possibilities of an amine-glycol combination were carefully considered. It was found that an amine-glycol solution containing about 20% of water would absorb hydrogen sulphide readily, but was fairly viscous at atmospheric temperatures. The high viscosity of the solution would probably affect absorption of hydrogen sulphide and water vapor adversely and would decrease the heat transfer coefficient of the solution to a small degree. But these adverse factors could be compensated for by proper design of equipment.

The possibility of the thermal decomposition of the amine in the reactivation still appeared to present a more difficult problem. The amines as a class are more or less unstable at high temperatures. Previous commercial use of amines for gas purification had involved heating the amine to about 220° F. A temperature of about 300° F. is maintained in the reboilers of the reactivation stills in the glycol dehydration plants. Laboratory tests showed that a commercial mixture of amines decomposed at a measurable rate when a solution of the amines in diethylene glycol was maintained at a temperature of 260° F. This question of thermal decomposition of the amine appeared to be of great importance, due to the expense of replacing the decomposed amine, and also due to probable loss of plant efficiency caused by deposition of the decomposition products on the heating surfaces in the plant.

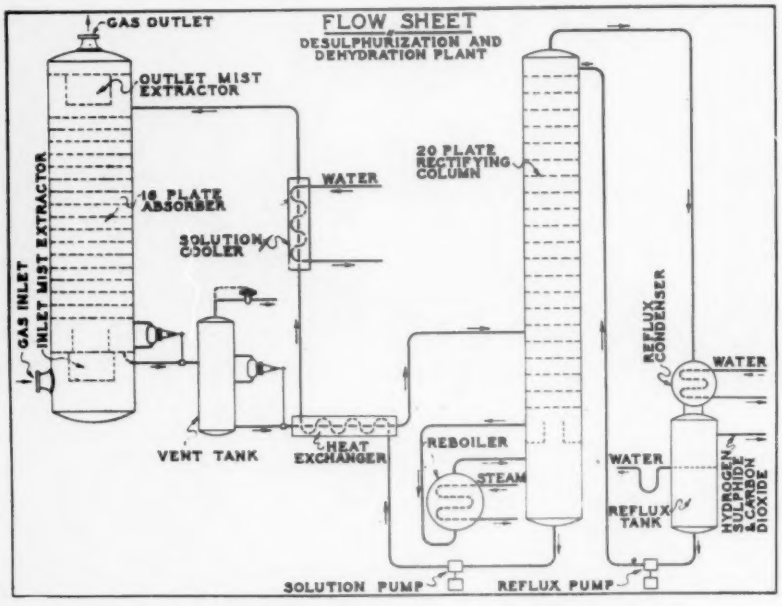

Figure 2. Desulphurization—dehydration plant

The possibility of the use of a sodium phenolate-diethylene glycol mixture was considered. This mixture should have several advantages including high absorption of hydrogen sulphide per gallon of solution, high thermal stability, and no affinity for carbon dioxide. Unfortunately, rough laboratory tests, that have since been proved to be in error, indicated excessive gum formation when the solution was heated. Tests on a larger scale have subsequently shown that gum formation does not occur under operating conditions, and that this combination would be successful in commercial operation. However, it was decided not to use this combination in the Rush County plant in view of the early experimental results.

Other tests indicated that a diethylene glycol-monoethanolamine mixture should be fairly stable at 260° F. Time did not permit any extensive experimental work on this mixture, but the plant was designed from the available data to use a diethylene glycol-monoethanolamine mixture. All plant units were designed where possible so they could be used either in a straight desulphurization plant or in a straight dehydration plant. Then in the event of failure of the combination plant, the apparatus could be utilized in the construction of conventional plants. However, much additional equipment would be required, and much additional expense would be involved, if it were found necessary to substitute a conventional desulphurization plant and a dehydration plant for the proposed combination plant. The flow sheet of the plant as built is shown in Fig. 2. This plant has a designed capacity of 40,000 M cubic feet per day at 400-500 pounds per square inch gauge pressure with 20 grains of hydrogen sulphide per 100 cubic feet of inlet gas.

It was estimated, prior to plant operation, that the treated gas would have a dew-point of 30-40° F., and would contain about 0.7-0.8 grains of hydrogen sulphide per 100 cubic feet. The plant was put in operation November 2, 1937, and has been operating practically continuously since that time. The dew-point of the treated gas has been determined as averaging about 0° F. and the hydrogen sulphide content of the gas has consistently been less than 0.2 grains per 100 cubic feet, even though the hydrogen sulphide content of the raw gas has run as high as 50 grains

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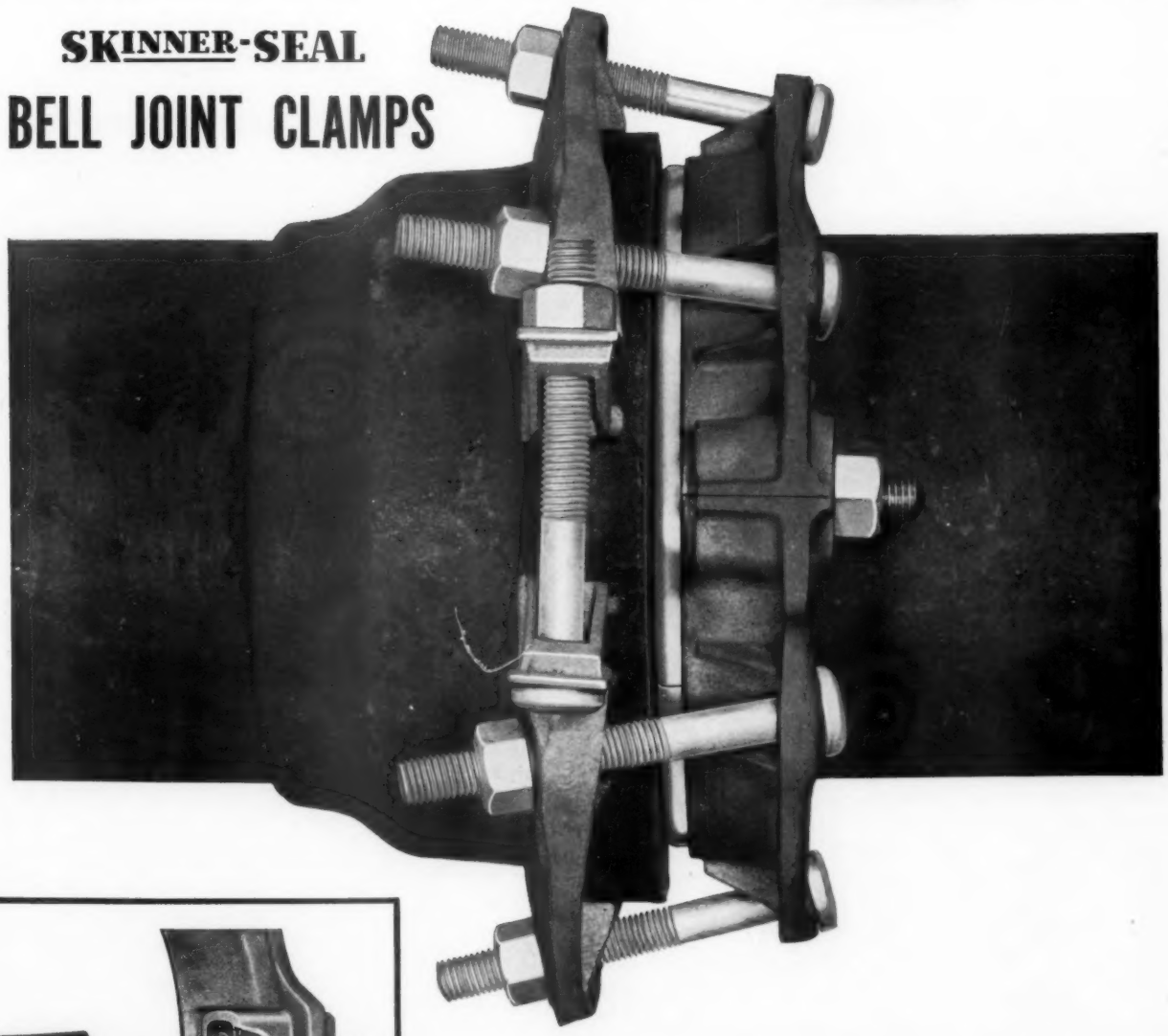

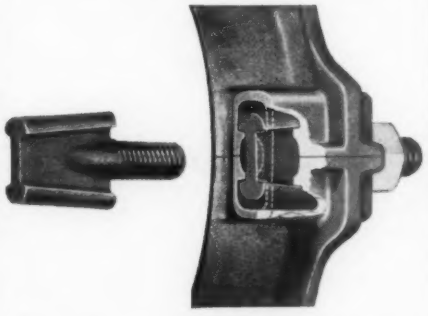

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per 100 cubic feet instead of the maximum of 20 grains that was originally estimated. Operating data covering the first four months of operation show that 1,934,000,000 cubic feet of gas have been treated with a total glycol loss of 190 gallons, and a total amine loss of 30 gallons. On this basis, the cost of chemicals consumed per thousand cubic feet of gas treated is roughly a quarter of a mill. Steam and cooling water consumption are both lower than were anticipated, due to the elimination of reflux from the reactivation still. Power consumption also is low, as the solution rates do not exceed 25 gallons per minute on this plant. No operating difficulties have arisen to date, and there has been no evidence of excessive plant corrosion, or of gum deposits on the heating surfaces. Overall treating costs are largely affected by the actual life of the plant, and by the load factor at which the plant operates. Royalty payments must also be considered in this connection, as basic patents are held by Girdler Corporation on the use of amines for desulphurization of gas and other patents have been applied for. Estimates at present indicate that the total treating cost in this particular plant including depreciation, corrosion allowance, and maintenance will be about 1.5c per thousand cubic feet with an average annual load factor of 20% of plant capacity. Table 1 shows plant operating data in some detail.

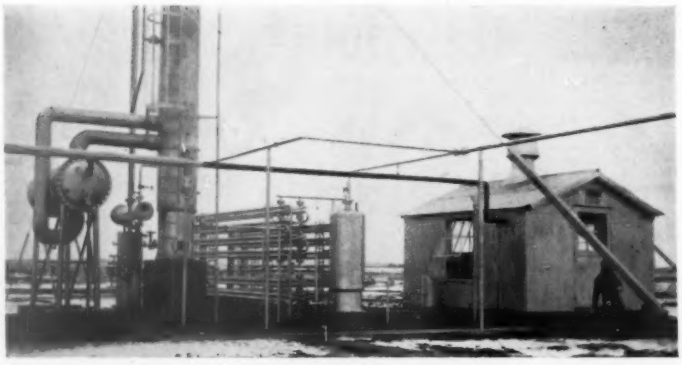


Figure 3. Reactivation still

changers, and coolers. The operation of the plant is automatic, as the solution rate is determined by the pump speed. Liquid level controllers on the liquid outlet from the absorbers and vent tank maintain a constant feed of spent solution to the still at a rate equal to the pumping rate. The base of the reactivation still serves as a surge tank, to equalize slight discrepancies between the solution rate to and from the still. No reflux is returned to the still under present operation. Condensate leaving the reflux condenser is accurately measured to give a check on dew-point determination, and the amine content of the condensate is periodically determined.

The results actually obtained by the plant, as listed above, were found to be far better than the estimated results. These favorable results have

TABLE 1

OPERATING DATA—DEHYDRATION-DESULPHURIZATION PLANT

	Nov., 1937	Dec., 1937	Jan., 1938	Feb., 1938
Gas treated (Million cu.ft.)	515.5	672.7	413.3	332.4
Gas pressure (Pounds per square inch gauge)	402	396	392	389
Gas temperature (Degrees F.)	58	52	49	47
Treated gas—Dew-point (Degrees F.)	4.7	0.0	0.4	0.0
Treated gas—Hydrogen sulphide (Grains per 100 cu.ft.)	0.25	0.10	0.14	0.05
Raw Gas—Hydrogen sulphide (Grains per 100 cu.ft.)	23.4	25.7	13.3	20.0
Still kettle temperature (Degrees F.)	260	260	260	260
Still pressure (Pounds per square inch gauge)	5.0	5.0	5.0	4.7
Reflux to still (Gallons per hr.)	0	0	0	0
Glycol make-up (Gallons)	10	80	50	50
Amine make-up (Gallons)	0	0	25	5
Solution rate (Gallons per min.)	19.6	23.0	17.7	11.1

The circulating solution used contains 7-8% monoethanolamine, 75-80% diethylene glycol, and 12-16% of water by volume. Figure 2 is a general view of the plant, showing the absorber on the left and the reactivation still on the right. Figure 3 shows the base of the reactivation still, the pump house, reboiler, reflux condenser and receiver, solution make-up tank, and solution heat ex-

largely been obtained by the elimination of reflux from the reactivation still. Amine desulphurization plants have required reflux in the reactivation still to prevent excessive loss of amine in the vapors leaving the still. Glycol dehydration plants have used reflux in the reactivation still to prevent loss of glycol overhead. In the combination plant, hydrogen sulphide and carbon dioxide are liberated from the amine compound rapidly, and without sustained boiling of the solution. These liberated gases serve to reduce the partial pressure of water vapor over the solution in the still kettle, and hence assist in stripping water vapor from the solution. The still kettle temperature has been maintained at 260° F. consistently. Decomposition of the amine-hydrogen sulphide compound is more rapid at this temperature than it is at the lower temperatures at which amine-water solutions are generally regenerated. The presence of the glycol may also assist in increasing the decomposition rate of this compound. Further, the presence of the glycol probably tends to reduce vaporization of the amine. However, plant records indicate that results obtained may be slightly affected by the relative amounts of acid gases and of water vapor that are liberated in the still.

The total elimination of reflux to the reactivation still reduces the amount of heat that must be applied to the still, and therefore increases the economy of plant operation. Analyses of the overhead vapors from the still show that the loss of amine and glycol in these vapors is very small. The small magnitude of this loss is shown definitely by the fact that only small amounts of glycol and amine are added to the plant as make-up. Thus, the use of the combination solution in a single plant, rather than the use of two separate solutions in two separate plants, enables superior operating results to be obtained at lower operating costs with reduced initial investment.

It appears that the amine-glycol combination may be useful for dehydrating sweet gas that contains some carbon dioxide where low dew-points are required. It also appears possible to effect economies in the desulphurization of sour gas by the use of the glycol-amine solution, even through dehydration of the gas is not required.

The Flow of Fluid Through Pipes

Part 2

by

Allen D. MacLean,

Chief Engineer
Pittsburgh Equitable Meter Company

The method given of computing pressure loss* in its relation to rate of flow, line size, etc. has some advantages over some of the existing formulae for pipe flow. Many of the equations used such as Weymouth, Unwin, Oliphant, Cox and Pole for gases and Hazen-Williams for water do not take into account the variation of friction factor with Reynolds number, but assume a constant value of f. This assumption, experimental work has shown, is incorrect, and in reality limits any formula to that range in which the experimental data to derive the formula was obtained. This range is not normally known, and therefore the formula may be misapplied. The type of formula presented here is good throughout all ranges met with in flow work. There is no limitation based upon original data since the actual friction factor curve is based on a large amount of data from widely divergent sources.

Another important advantage in using the system presented here arises when we consider the variation in pipe roughness. Unfortunately pipes do vary in internal condition, and this is difficult to express in mathematical terms. By using the fan-wise family of curves as shown in the upper right hand section of Fig. 4 (part 1) the experience gained by others in the matter of pipe roughness can be used. The table accompanying the graph lists the previous experience on which each curve of the family is based.

* See Part I of this article, May issue.

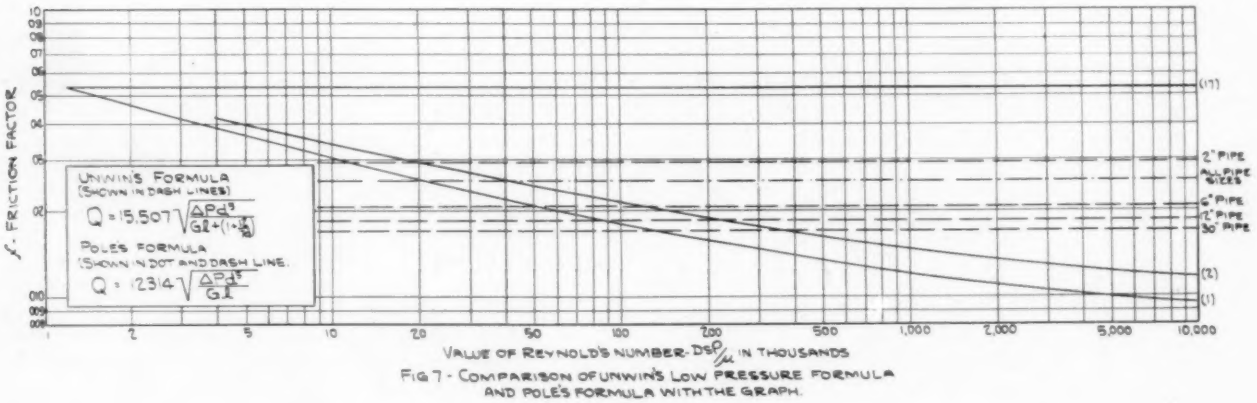


FIG 7 - COMPARISON OF UNWIN'S LOW PRESSURE FORMULA AND POLE'S FORMULA WITH THE GRAPH.

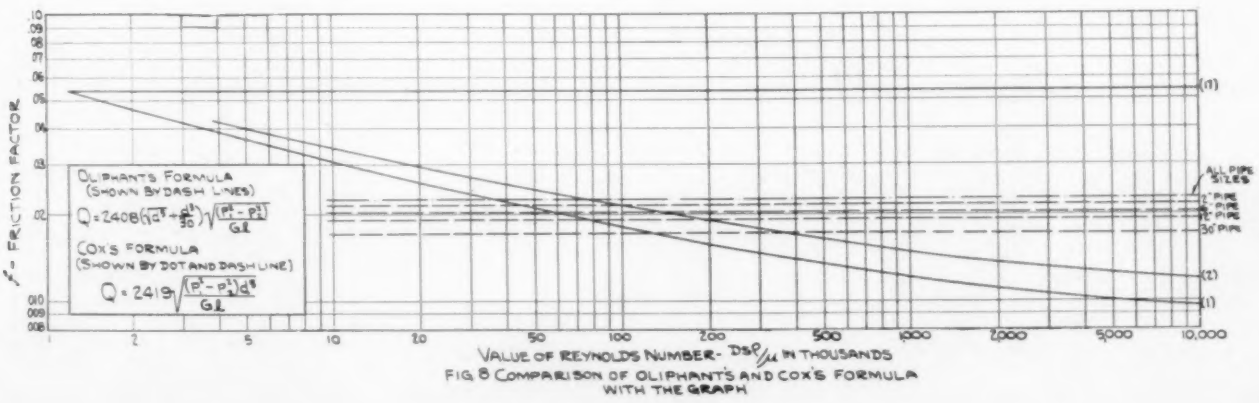


FIG 8 COMPARISON OF OLIPHANT'S AND COX'S FORMULA WITH THE GRAPH

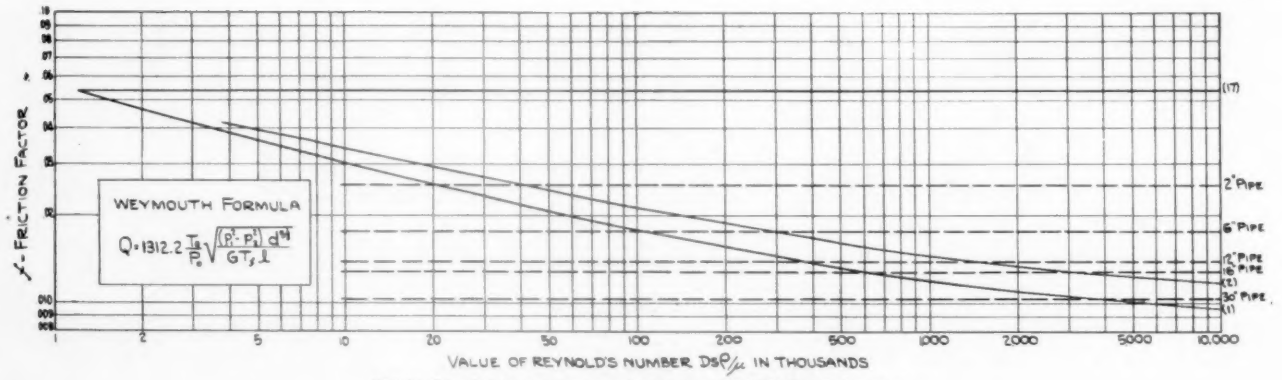


FIG. 9 COMPARISON OF WEYMOUTH HIGH PRESSURE FORMULA WITH THE GRAPH

In addition to this table, it is conceivable that each individual in time will accumulate practical experience to guide in selecting which curve of the group to use. Actual observations in the field will eventually lead to the constant use of one of the lines for each type of work. This accumulation of experience is not possible in using straight mathematical formulae for pipe flow.

To show the relation of the formula as presented here to some of the accepted formulae which have been previously used, a number of graphs are shown in a manner to give a direct comparison.

To make this comparison, sets of conditions are assumed, and an unknown factor computed by means of one of the formulae. These conditions are then substituted in equation 13

$$P_1 - P_2 = .000003359 \frac{f\, w\, Q^2\, l}{d^5}$$

and f is solved for. Then by plotting f as thus determined, against the Revnolds number for that particular set of conditions, a direct comparison can be made with the f shown in the upper right section of Fig. 4 (part 1).

In Fig. 7 we have followed this procedure with Unwin's formula, which is used quite extensively for low pressure gas. It will be noted that the f curve is a straight horizontal line, not varying with Reynolds number, but of a different vertical value for each pipe size. The lines for Unwin's formula are drawn dotted, and can be compared to our standard formula, which is shown in solid lines. For conditions of flow represented by high Reynolds numbers, the Unwin values of friction are higher and for low Reynolds numbers tend to be lower than our standard curve.

Pole's formula, oftentimes used with low pressure gas, is shown in dot and dash lines.

Figure 8 in dotted lines shows Oliphant's formula, and in dot and dash lines the Cox formula.

For high pressure gas, Weymouth's formula has been extensively used, and is shown in comparison with our standard formula in Figure 9.

For water the Hazen-Williams is quite generally used, and makes some allowance for pipe roughness in choice of constant. Figure 10 shows its comparisons. It will be noted that this formula shows quite a close agreement with the formula presented in Fig. 4 (part 1).

This group of graphs, Fig. 7, 8, 9 and 10 illustrate the main difference in method as proposed by the graph in Fig. 4. The method proposed permits; first, rapid determination of Reynolds number, permitting determination in Reynolds number with pipe size in making preliminary calculations in which pipe size has not yet been determined; second, visual selection of friction factor in light of past experience; third, complete allowance for nature of flowing fluid, since both density and viscosity are used; fourth, rapid computations of unknowns once the friction factor is determined; fifth, possibility of accumulating experience for any particular type of work to help in selecting which friction factor curve to use. It is felt that these points constitute important improvements in fluid flow work, and permit closer and more accurate determinations of all factors influencing flow.

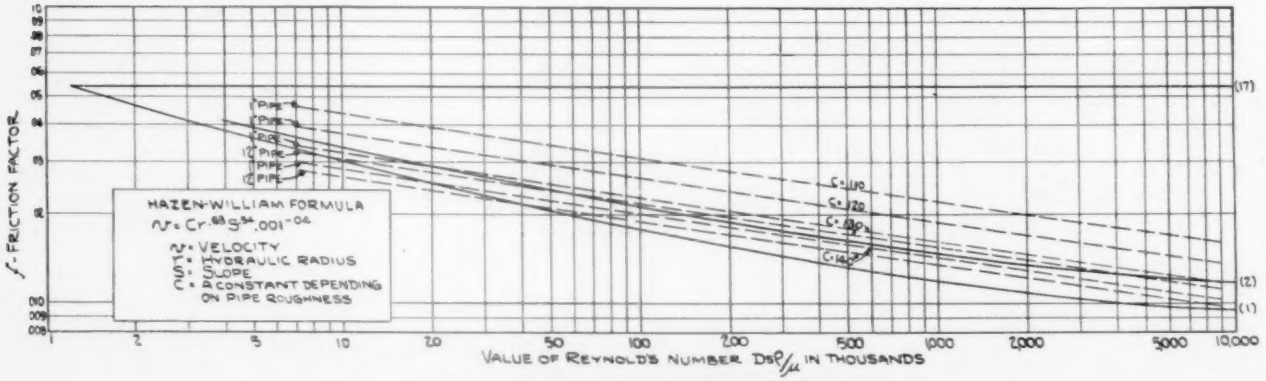


FIG 10 COMPARISON OF HAZEN-WILLIAM FORMULA WITH THE GRAPH

The Manufacture of High B. T. U. Carburetted Water Gas*

By
H. Vittinghoff
Stone & Webster Engineering Corporation

DURING 1937 the Public Service Company of Northern Illinois decided to build an addition to a plant to produce high B.t.u. carburetted water gas and commissioned Stone & Webster Engineering Corporation to design and construct such a plant. The company normally purchases all of its mixed gas requirements through The Peoples Gas Light & Coke Company of Chicago and this gas is a mixture of natural gas, reformed natural gas, coke oven gas, and carburetted water gas. The proportion of components varies materially from season to season but they are always so adjusted as to produce a mixed gas with reasonably constant burning characteristics as well as a uniform heating value of 800 B.t.u. approximately.

In building this plant Public Service had three specific purposes in view: First, to maintain itself in position to produce a certain number of therms of gas per day. Second to produce gas which when mixed with the gas obtained from Peoples Gas would augment the natural gas purchased by the combination of the two companies in such a way as to control the load factor of natural gas purchases. Third, to make a gas which could be substituted for the mixed gas normally furnished by Peoples Gas in the event of a natural gas service interruption.

Under the conditions governing operation of Public Service Company, their production plants are currently called upon to operate only for relatively short periods annually, and obviously it was necessary to develop a plant low in capital cost so as to reduce to a minimum fixed costs on the gas produced. At the same time the plant had to be such that in emergency it could be started up quickly and brought to proper functioning within a very short period of preliminary operation.

The generating equipment finally selected was a 12 ft. Semet-Solvay Engineering Corporation Reverse Flow Set equipped with a 9 cam U. G. I. automatic control and a turbine driven blower capable of delivering 32,000 cu. ft. per minute under a pressure of 50 inches, all housed in a new steel-frame building. The set was equipped with hot valves since it was felt that in the production of high B.t.u. gas the capacity of the carburettor and superheater would be heavily taxed due to the large quantity of oil which had to be handled per cycle and, therefore, the back run system of operation appeared to present no merits. Auxiliary equipment was also provided, but does not require any further description since it was of standard design and did not differ in any respect from the usual apparatus found in water gas plants.

The details of construction of the set are well known through the descriptions disseminated by Semet-Solvay Engineering Corporation and the following discussion concerns itself mainly with the results obtained during the acceptance test.

It was recognized that, especially with respect to the phase of the problem referring to the production of a substitute gas similar in characteristics to that furnished by Peoples Gas Company, the operation of the set was largely a matter of experimentation and that in starting up the operators would have to feel their way in order to develop the most suitable procedure. For this reason, but particularly because of the stringent requirements as to interchangability of gas placed upon the production department by the distribution department of the Company, the test work as actually carried out was restricted to relatively short periods on the days when the set was operated. Actually during the test period extending over approximately five weeks, the set was operated at about 1/10 of normal daily rating. The long shut-downs and short daily operating periods naturally had an adverse effect on the results obtained

From Operating Floor. Showing upper hot valve (52") carburetor, superheater and riser pipe to stack wash box and overflow.

Presented at the A.G.A. Joint Committee Conference of the Production and Chemical Committees, New York, May 23, 1938.

From Operating Floor. Riser pipe, carburetor and hot valve. Automatic control in background.

U. G. I. Automatic Control and Semet-Solvay Gauge Board

and it is reasonable to assume that normally much better efficiencies could be obtained both in respect to solid fuel and oil consumption.

The materials used were a high grade of by-product coke with very low ash content and a 32° to 34° A.P.I. gravity gas oil of excellent enriching characteristics.

During the days when it was attempted to make a gas suitable to augment the supply of mixed gas furnished by Peoples Gas Company, the following results were obtained.

Date	Sp. Gr.	B.t.u.	H_2 Per Cent	MCF Make/Run	Gal. Oil per MCF
Jan. 10	.60	780	29.8	18.2	8.45
11	.64	826	32.6	20.0	8.60
12	.62	794	31.8	21.6	8.25
14	.62	825	33.3	18.7	9.10
19	.64	830	27.9	17.9	8.40
20	.62	844	33.4	18.4	8.41
28	.63	832	30.5	16.7	8.20
31	.64	829	25.9	15.6	8.27
Average	.626	820	30.6	18.4	8.46

It will be noted that there is a considerable variation from day to day in the specific gravity, heating value and hydrogen content of the gas manufactured, but since each of these days represents only a relatively few hours of operation it can be safely assumed that under normal conditions such variation would be smoothed out as the gas passed through the relief and storage holders before it is delivered into the distribution system. Furthermore, under continuous operation the large variations shown by the above figures would not have occurred.

While the production department was making this gas the distribution department of the company conducted a series of tests on a large number of appliances under widely varying burner adjustments representing the extremes of adjustments which might be found in the field and it was shown that the gas as made was entirely suitable to be mixed in equal proportions with gas furnished by Peoples Gas Company and to be sent out into the distribution system without in any way inconveniencing any customers through the malfunctioning of appliances. It is true that the burning characteristics of the gas manufactured in the set were somewhat different from those inherent in the gas furnished by Peoples Gas Company as could be noted in the laboratory when changing from one gas to the other. It is to be questioned that any but a very few customers would actually observe any change in behavior in their own appliances. A typical analysis of the gas made is represented by the results obtained on January 28 and is shown below:

CO_2	1.1%
Olef.	15.8%
O_2	0.6%
CO	13.7%
H_2	30.5%
CH_4	33.1%
C_2H_6	1.4%
N_2	3.8%
Blue Gas .....34.7%— 297	B.t.u.
Oil Gas .....65.3%—1140	B.t.u.
Cu. ft. Oil Gas per gal....	79.8
B.t.u. per gal.....	91200

A typical analysis of gas furnished by Peoples Gas Company to Public Service Company of Northern Illinois is stated to be as follows:

CO_2	1.0%
Olef.	2.1%
O_2	0.2%
CO	2.8%
H_2	24.8%
CH_4	55.6%
C_2H_6	6.8%
N_2	6.7%

A 50-50 mixture of this gas with the gas manufactured during the test under consideration would have a composition as follows:

CO_2	1.0%
Olef.	9.0%
O_2	0.4%
CO	8.3%
H_2	27.6%
CH_4	44.4%
C_2H_6	4.1%
N_2	5.2%

It is interesting to note that this mixture which, by the consensus of opinion of all concerned was a satisfactory substitute for the gas normally sent out by Public Service Company of Northern Illinois varied largely in chemical composition from the latter gas. However, it is not claimed that the gas made in the set during these particular test runs would be satisfactory under normal conditions as a 100% substitute for the gas normally delivered by Peoples Gas Company.

It was not possible to determine accurately the weight of fuel used for production as distinguished from the total fuel used for both production and bringing the set up to heat after long stand-bys, but from such observations as could be made it appears that the fuel consumption was not in excess of 21 lb. of coke per MCF while the oil consumption to make 820 B.t.u. gas averaged only 8.46 gal. per MCF or approximately 8.25 gal. for 800 B.t.u. gas. Under normal conditions the set should perform at the rate of 10.5 cycles per hour so that during a 22 hour operating day the rating of the set as established by the intermittent test works out to 4250 M cu. ft. of 820 B.t.u. gas equivalent to 35,000 therms per day.

One of the conditions which the manufacturer of the set undertook to meet was the continuous operation of the set without an undue amount of difficulty from lampblack or heavy tar formation. On the basis of the observations made during the test period it can be definitely stated that when making a gas with a gravity of .62 or .63 the operators will not encounter any difficulty in the handling of tar nor will carbon deposits tend to be built up in the machine.

The above tests indicated that the machine could readily make the required quantity of gas of a quality suitable for admixture with gas furnished by Peoples Gas Company, but it remained to be shown that the machine could make a substitute gas which could be burned in the appliances of the customers of Public Service Company of Northern Illinois without having to resort to a general campaign of appliance adjustments or, indeed, without inconveniencing the customers because of the change in gas characteristics especially in connection with appliances now adjusted on the hard side i. e., appliances with air shutters adjusted so as to give a relatively large proportion of primary air and a relatively small proportion of fuel. The operators of Public Service Company thought that an ideal situation would be for such gas to have a specific gravity of about 0.54 and a hydrogen content not in excess of 32%. This objective was not quite reached as any attempt to reduce the gravity to the point indicated was always accompanied by an increase in hydrogen content which was not desirable because of its effect on burner performance.

In this connection it is to be recommended that any comparison of gas analyses always be made with reference to a certain standard of analytical equipment. In connection with a similar problem, test—results were submitted which purported to indicate the hydrogen content of a gas made during a continuous run:

Sample 1	Time 11 A.M.	25.3%
Sample 2	Time 2 P.M.	36.2%
Sample 3	Time 7 P.M.	23.6%
Sample 4	Time 12 Midnight..	36.2%
Sample 5	Time 5 A.M.	22.9%
Sample 6	Time 10 A.M.	27.6%
Sample 7	Time 2 P.M.	32.8%
	Average	30.0%

The difference between the average and samples No. 2 and 4, which show a relatively high percentage of hydrogen, is that the latter were analyses made in a Bureau of Mines apparatus, while all the other samples were analyzed on another well known type of equipment and showed much lower hydrogen content. All analyses referred to in this discussion were made on the Bureau of Mines apparatus, while an Edwards Balance was used to determine specific gravity.

During the trials when it was attempted to make a low gravity high B.t.u. gas, the following results were obtained:

Date	Sp. Gr.	B.t.u.	H_2 Per Cent	MCF Make/Run	Gal. Oil per MCF
Jan. 10	0.57	787	36.5	20.5	8.10
20	0.58	794	37.8	18.3	8.60
25	0.59	8.2	35.1	17.1	8.52
26	0.57	795	39.8	18.9	8.78
27	0.57	781	36.9	17.1	8.97
Average	0.576	794	37.2	18.4	8.59

A typical analysis of this type of gas is represented by the following:

CO_2	0.7%
Olef.	10.5%
O_2	0.5%
CO	11.9%
H_2	36.5%
CH_4)	34.1%
C_2H_6)	
N_2	5.8%
Blue Gas .....31.0%—277	B.t.u.
Oil Gas .....69.0%—953	B.t.u.
Cu. Ft. Oil Gas per gal.....	85.2
B.t.u. per gal.....	81000

The capacity of the set was practically the same as that observed when making gas of somewhat higher gravity while the oil consumption rose only to 8.59 gal. per M for making 794 B.t.u. gas which is equivalent to approximately 8.7 gal. per M for 800 B.t.u. gas. The hydrogen content of this gas was somewhat higher than desired and the burning characteristics were markedly different from those of Peoples Gas mixture. However, the only case of a malfunctioning of any of the applicances which was observed occurred in the case of a single burner which had been deliberately adjusted to produce an extremely hard flame with the Peoples Gas mixture and which flashed back when the pressure on the burner was deliberately lowered from 5" to 3"—an extreme test. If in an emergency it had become necessary to distribute this gas in substitution for Peoples Gas, it is believed that the situation could have been adequately met without putting a serious strain, in the form of complaint calls, on the distribution department. The tests made in the laboratory on the appliances were not, and could not be, sufficiently all inclusive to permit positive proof of such a statement. The belief expressed is based on the consideration that since a mixture of equal parts of gas furnished by Peoples Gas Company and 0.63 specific gravity gas manufactured in the set resulting in an average specific gravity of 0.59 was actually sent out into the district without causing any increase above the normal number of daily

complaint calls whatever, therefore, if in an emergency, gas be sent out having a gravity of 0.576 such gas should not result in a undue increase in complaint calls, even though the somewhat higher percentage of hydrogen would result in a change in burning characteristics.

While making gas of this lower gravity, it was observed that greater quantities of carbon were deposited in the set than when 0.63 gravity was made and some trouble was experienced due to heavy tar. The carbon deposits which were observed were not so heavy but that regular scurfing of the set for one or two hours a day should prevent the blocking of any part of it with carbon and the trouble experienced with heavy tar was not so serious but that with close attention given to this phase of operation any intereference with production needs be feared.

As a matter of fact only the heavy tar which settled in the cone bottom of the wash box and which was not carried out of the wash box regularly with each cycle was the cause of the minor trouble experienced, and it was found that when this heavy tar was mixed with the light tar simultaneously formed and carried away regularly, the mixture became sufficiently fluid to permit normal handling by the available pumping equipment. A slight modification in the method of handling the tar from that pursued during the test period should avoid any serious difficulty from this source.

The manufacturers of the set proposed two alternative methods of operation, one, the standard "up and down cycle" and the other a so-called "heat up cycle" which consisted of a standard blast followed by an up-steam run and followed in turn by a reheat period during which steam was passed downward through the generator and the resulting blue gas burned in the carburettor and superheater, this reheat period being followed by a second up-steam run. The two cycles are illustrated by diagrams on which are also indicated numerical values relating to temperatures and quantities of air steam and oil

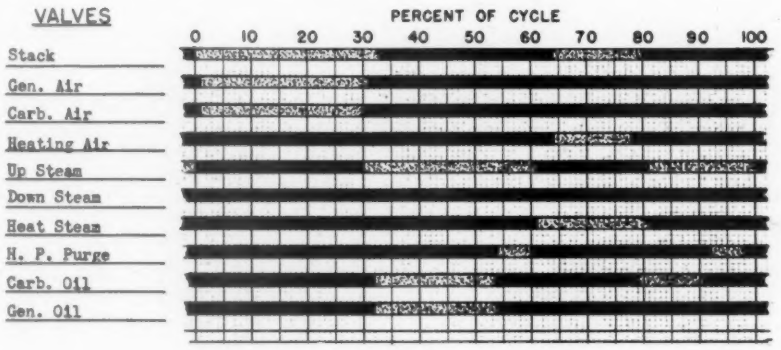
(Concluded on page 50)

CYCLE DIAGRAM

HEAT UP CYCLE

PLANT Niles Center DATE _____

OPEN CLOSED



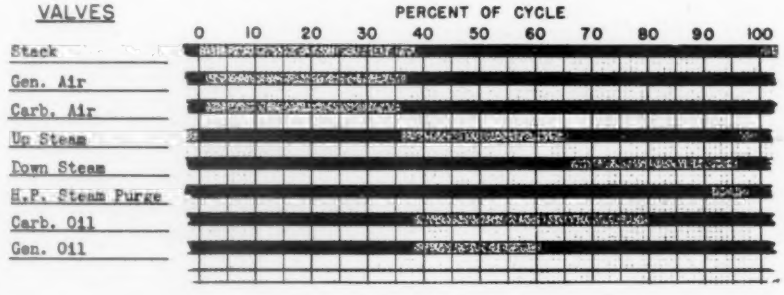
Remarks: Sp. Gr.	0.57-0.58	0.61-0.62	0.65
Temperature T_3 (Middle of Superheater)	1725°	1630°	1580°
Up Make Steam lbs./min.	60	60	60
Down Make Steam lbs./min.	60	60	60
Generator Air cu. ft. per min.	12000	11000	10200
Carab. Air cu. ft. per. min.	12000	11000	10200
Total Oil-gals.	154	148	135
Oil on Fire	10-15%	10-15%	10-15%

CYCLE DIAGRAM

UP & DOWN CYCLE

PLANT Niles Center DATE _____

OPEN CLOSED



Remarks: Sp. Gr.	0.57-0.58	0.61-0.62	0.65
Temperature T_3 (Middle of Superheater)	1725°	1630°	1580°
Make Steam lbs./min.	60	60	60
Heat Steam "	140	140	140
Gener. Air cu. ft. per min.	12500	11500	10800
Carb. Air " "	11000	10500	10000
Heat Air	14200	14000	13700
Total Oil	154	148	135
Oil on Fire	10-15%	10-15%	10-15%

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BARBER GAS PRESSURE REGULATORS

"Time Marches On:"—Where Is Manufactured Gas Marching?*

by
A. M. Beebee,
General Supt.,
Rochester Gas & Electric Corp.

ANY industry to have a place in our present civilization must have a definite purpose, and ours is to supply part of the energy necessary to operate our modern system of society.

Gas and electricity are merely convenient forms of transmitting energy. Coal, and oil are forms of transmitting energy, as well as sources of energy. The manufactured gas industry that we are here considering is a century old industry with a huge investment, we are told, of some $30,000 per employee and a total investment of some $2,500,000,000. Because it is old and large, in these modern times, may be the reason for some to feel it has outlived its usefulness, quite as some of our stately and spacious mansions on the highest class residential streets of our many cities.

I know of no better way to analyze this problem than to assume for a moment that we could turn the hands of time back and start to build America all over again, with, however, all of our technical knowledge of today available. Let's assume America was still only inhabited by the Indians, and that over-night we could build it up in any fashion that we chose as being most in keeping with our present day technical knowledge.

Would this stately old manufactured gas mansion be built in the modern streamlined America? To answer this, we must study the fundamentals that are involved. We know that all our energy comes from the sun. Some is made available direct from the sun, through evaporation of the water on the surface of the ocean, lakes, etc. which condenses over the land making rivers and falls which may be harnessed. This however, if every conceivable waterfall in the country is harnessed, we find can supply only about 27% of our present requirements, and at the present time is only supplying some 10% of our energy requirements.

Our more prolific sources of energy are coal, and oil and natural gas, which energy came from the sun over a period of millions of years in the development of animal, fish and vegetable life whose remains formed these materials which we now use to supply our needs. These sources of energy are unreplaceable and when gone, they are gone forever.

When we make a survey, we find that the reserves of coal in this country are tremendous and that the known reserves of oil and natural gas in this country are definitely limited, in spite of the present apparent flood of these materials. Geophysical means of exploring, and the tremendous increase in geological information, have been responsible for developing the largest fields the world has ever known, which, coupled with our basic "right of capture" law has forced a deluge of these materials on our already saturated energy market. The basic law of our land on this subject comes from a decision several generations ago, which called natural gas and oil "migrating minerals" and likened them to "migrating animals and birds," which if shot on one's own land belong to that land owner, but if they trespass on to a neighbor's property and are there shot, they belong to that latter party. Thus when a field is opened there arises that race to capture, that floods a market, since the early bird can drain the materials under the property of another. Coal, not being of a migrating nature, is not subject to that race of withdrawal, in spite of its tremendous amount.

We find that the total known oil reserves of the country at present rates of use will last some 12 to 13 years and that the tendency to develop new reserves during the past five years is considerably below present rate of use, in spite of increased knowledge of geology and geophysical exploration. The more obvious geological conditions have been picked and deeper and deeper drilling has been carried out, so that the cellar of sedimentary rocks has been approached. The organisms responsible for these oil and gas deposits existed in prehistoric seas and therefore these fuels are found only in rocks which are the result of sedimentation. When we approach rocks of the "Precambrian period," which are the result of "igneous" or molten conditions, all forms of life, even if it ever existed, were obliterated. Furthermore, the deeper drilling, in general, involves denser rocks, so that the essential "pore space" necessary for commercially adequate "reservoir rocks" tends to be lacking, as well as involving more expensive recovery costs.

Therefore, as time goes on the popular impression that we merely drill deeper and get more oil has a very definite limit. This is an important point to be considering, because oil now supplies some 30% of our total energy requirements.

Unquestionably new fields will be discovered but in general the "plums" have been picked. A very fine survey of this subject by Wallace Pratt, Vice-President of Humble Oil, will be found in the March 25th, 1937, *Oil and Gas Journal*. This study shows that new field dis-

* *Part of a Paper Presented at A.G.A. Joint Committee Conference of the Production and Chemical Committees, New York, N. Y., May 24, 1938.*

coveries passed through a maximum in the late 1920-1930 period, that most of the obvious fields appear to have been found, and that the years 1935 and 1936 were very active exploration years, and yet the rate of finding oil in the last 6 years was only about 70% of the rate of utilization.

Natural gas is in a relatively similar situation. This is especially true in the total Appalachian fields east of the Mississippi. The mid-continent and California fields, however, are tremendous, so that total known reserves in this country will last present rates of withdrawal from 20 to 25 years. Gas is a bulky substance. You can put 10 gallons of gasoline in your car and drive all day. To do the same with gas, even if compressed to 2,500 lbs. requires a tank ten times as large. This means that for natural gas fields to be commercially successful a well must drain "reservoir" rocks of ten times the capacity of that necessary for a commercial oil well. The location of "reservoir rocks" of such porosity and thickness and of adequate permeability are few and far between, though gas, by reason of its greater "migrating power," due to its lesser "viscosity" tends to offset this great handicap. Natural gas we find now supplies some 7% of the nation's energy requirements.

Coal on the other hand, we find, up until a decade ago supplied some 60% of our energy requirements, though due to the increased development of natural gas, oil, and water power, now supplies but 45% of our energy requirements. Yet we find this country has a coal reserve which at present rates of use will last over 4,000 years, and if used at a rate to supply nearly all our requirements will last some 2,000 years.

Few realize that the energy in a pound of coal is some four to five times that in a pound of our most powerful explosives, such as T.N.T., and that a ton of water must fall a mile to develop the energy equivalent of a pound of coal. When all conversion efficiencies are considered, it must fall one-quarter mile to produce in electrical form the energy that can be generated from a pound of coal. It is interesting to note that the entire flow of the Niagara River over the great Niagara Falls is only equivalent to an imaginary coal stream flowing at a rate only slightly faster than a walk in a pipe line only 18" in diameter.

From all the above, we cannot help but conclude that coal is the source of energy of the future in this country, and that as time develops, the tendency of oil and natural gas to crowd out coal will reverse itself in the very near future. This will be especially so as the ability to withdraw the oil from the sands becomes more and more difficult due to the initial "head" of the fields being reduced, and resort to pumping and pressure driving becomes necessary to produce the oil. This condition invariably results as fields become older.

At this point it may be well to digress at the risk of repeating what has been previously presented ("Economics of Energy Distribution" — 1936 A. G. A. Convention) two years ago, and state two most important factors that seem self-evident, and which justifies their being repeated, as they cannot be emphasized too strongly, especially at these times.

(a) The tendency to return to coal and the resultant spreading of employment and purchasing power, both at the mines, railroads and plants and the heavy industries which supply these industries, would seem to again set in motion the favorable economic cycle which existed in the period 1923 to 1929 when coal was 60% of our requirements, instead of the present 45%, which latter resulted from the increased use of water power, oil and natural gas, which forms of energy use a minimum of labor in their production.

(b) It is almost suicidal folly to develop hydro-electric power (which is the world's worst employer of labor) in a country such as ours, which has adequate coal reserves. The adoption of such policies, in countries like Canada and Sweden, who have no coal reserves, may be justified, even to the extent of subsidization, to prevent the constant drain on their natural wealth. But in our country, where unemployment is our greatest problem and spreading of purchasing power our greatest need, such a development is indeed a modern Frankenstein. There might be justification for such policies in this country if energy could be developed cheaper from water power than from coal, but where the reverse is true, it can only be couched in the terms of "asinine politics."

The testimony by the National Coal Association before the Senate hearing on July 1st last showed that the present hydro-electric developments of the Government are equivalent to 139 million tons of coal a year or 31% of the 1936 Bituminous coal production, and that the proposed plants will have a capacity of an additional amount equivalent to 199 million tons a year, or 45% of the 1936 coal production. The combined present and proposed hydro programs equal 338 million tons or 76% of the 1936 coal production.

The above should be remembered when we realize that such huge efforts are being made by Congress, the Coal Commission, the Guffey Act, etc. to stabilize the large labor employing coal industry, by artificially increasing prices of coal, which can only tend to force coal consumers to go to other forms of fuel. Doesn't such action seem pathetic, when greater use of coal, by not developing hydro power, would increase coal production load factor, reduce the cost of mining coal and tend to thereby broaden the competitive position of coal and increase its application and field of use.

The testimony just referred to showed that 50% of coal freight revenue goes to labor, and 65% of the cost of producing coal goes to labor and that each ton of coal lost to hydro power represents the loss of 1 day's work directly or indirectly employed in production and distribution of coal. Thus, these figures indicate that the Government's total hydro program involves the loss of 338,000,000 days work or the work of over a million men steadily 50 weeks of a year. It seems that this is indeed a sizable item in our unemployment situation.

Thus, we can conclude that both from the standpoint of conservation of the irreplaceable and definitely limited mineral forms of energy in our country, and the development of a sound social order, the quicker we develop the uses of coal the better; and the more we develop water power, the more we will delay those factors which are going to bring about our much sought after and apparently elusive "more abundant life."

Now to get back to our subject: The method of supplying the energy requirements to this America which we can build over night. Again we must consider some basic fundamentals. Gas and electricity are merely convenient means of transporting energy. In a modern America, the first thought would naturally be to have just one form of distribution; and perhaps to eliminate the two present forms of distribution. Some of our modern social planners appear to have fallen for this illusion. The energy in the coal at the mines can therefore be transported to market by rail in the form of coal or by conversion to gas, or by conversion

to electricity. We have all heard of the ideas of gas plants located at the mine mouth, and of electric plants located at the mine mouth. Now let's see what the general economics are.

Coal can be transported with a thermal loss of but a fraction of a per cent, while in the form of electricity the transmission losses run from 10 to 17%, and in the form of gas the energy losses, including pumping requirements are in the order of a very few per cent. Furthermore, very fine studies have been made recently (Frank F. Fowle—Combustion — March, 1938 "Economics of Subsidized Power") that very convincingly show that energy can be transported from 4 to 10 times as far in the form of coal on the railroads, for the same cost as in the form of electricity by high voltage transmission.

This fact, plus the limited condensing water facilities at the mine mouth operations, has blasted the popular fallacy, of a decade ago, of mine mouth electric generation and the high voltage transmission to market. In this connection it is interesting to read on Page 267 of the 1937 Report of the National Resource Committee on Technological Trends the following: "Furthermore, mine mouth location will ordinarily involve electric transmission costs greater than freight charges on fuel, and at the same time long distance transmission lines reduce reliability of service."

Thus the railroads transporting the coal to market are still the most economical means of transporting the energy and will probably continue in the future.

While it is true that energy in the form of gas can be transported in pipe lines at costs that more closely approach the costs of freight on coal for equivalent energy, nevertheless, mine mouth operation of gas plants will not be economic since the resultant by-products, such as coke and other materials must be transported to market, and these latter might just as well ride along with the coal in the first place, with the resultant saving. Therefore, railroad transportation of coal for gas plant needs located at the market also is sound and will probably continue in the future.

Therefore, whether gas or electricity or both is used to distribute the energy at the market to the many customers, coal is going to be transported by the railroads to the market to supply those needs.

Now when we come to analyze as to whether we should have one form of energy distribution or two at the market, we again must consider some fundamentals which may need repeating here. Energy in the form of fuels can be converted into useful heat with a high degree of efficiency even when including the conversion losses from coal to gas. However, where the energy in fuels is converted into energy able to do work, i. e., electricity or mechanical energy, large losses of the order of 75% are involved, whether the conversion is made by gas engine, boiler and turbine or any other known means of conversion. Now to take such energy which has experienced such heavy losses and convert it back into heat to supply heat requirements, which could otherwise be supplied direct from fuels without these losses, is not economic. In general, therefore, *where heat is required, some two to three times the amount of useful energy can be made available to a customer in the form of gas from a given amount of coal, as can be made available in the form of electricity.* Where light and power are concerned, both forms of energy are subject to these same heavy losses and electrical transmission for light and power needs has definite fundamental advantages, due to ease of application, lack of reciprocating parts, freedom from noise, etc. (For further details of this point see paper "Economics of Energy Distribution"—1936 A.G.A. Convention.)

The energy requirements of a given community in the form of heat are vast indeed, more than is usually realized, and are many times the requirements in the form of light or power. In fact, it may be well to recall that the present average energy requirements of our average American home today in the form of gas is some 10 times that in the form of electricity, and the average cost of the 10 times the energy in gas is not much greater than the smaller amount of electricity. Therefore, there are definite fundamental reasons for having both a gas and electric means of conveying energy to a community. Let us see what the utilization side of the question shows.

To supply the domestic cooking and water heating requirements there are those who would lead us to believe that the use of electricity for these purposes had latent advantages that enabled it to overcome the inefficiency of the process outlined earlier in this paper. Such activities, when carefully analyzed will be found to be promulgated largely by interests selling the appliances, or advocates of the Governmental power programs, in order to secure the load which they hope will make them self-supporting.

To develop the facts on this perplexing situation, many studies have recently been made, nearly all of which have led to the same conclusions. The most interesting of such studies that I have seen are those prepared by Mr. Herman Russell, entitled "Combination Company Sales Responsibilities" and which was given before the New York-New Jersey Regional Sales Conference at Rye, N. Y.—June 10, 1937, and the article by Mr. R. E. Ginna entitled—"Appraising Domestic Competition" before the New England Gas Association 1937 Convention.

These studies are well worthy of careful analysis. They show that combination gas and electric service for cooking, water heating and refrigeration of the homes in a community is to the best interest of the customer as well as the company and requires an investment only two-thirds that of the all electric plan. Briefly these studies show that the all electric cooking and water heating service to the customer is only profitable to the company at a cost to the customer twice the cost of the equivalent gas service, and at equal costs to the customer it is ruinous to the company*

The modern gas range, properly installed will provide a cleaner, cooler kitchen than competing fuels, including electricity, by removing cooking odors and grease vapors at the source along with the products of combustion in a properly constructed concealed flue, and will provide the service, on the average, for about one-half the cost to the customer. It may be argued that electric ranges may be flued to eliminate cooking vapors but if flued directly this is apt to have a serious effect on their efficiency. Broiling in modern gas range broilers can be made entirely smokeless and odorless through combustion of the vapors. This is quite an astounding fact, more so than at first may be appreciated and is only possible with fuels that will incinerate the cooking vapors. This is another reason why a gas range can provide a cleaner kitchen than an electric range.

Modern electric ranges, to equal gas range speed, have a connected load of 10 to 11 kw, or equivalent to a 15 H. P. motor. The output of an electric range is a function of the

* *American Gas Journal, March, 1937, page 21.*

square of the voltage and therefore it is most expensive to handle adequately loads of such poor load factor. It is particularly so, if uniformity of voltage is to result in order to avoid flickering lights, and provide the much touted "uniform" cooking. Here again we have the economic fundamentals definitely on our side, because in the case of gas ranges, the output is a function of the square root of the pressure. Therefore, variations in gas pressure affect the operation of gas ranges only to one-quarter the extent that variations in voltage have on electric ranges.

In addition to all the above, the oven temperatures of the modern gas range are far more uniform than in the modern electric range. Try it out for yourself. We did and the results are astounding. With the "on and off" operation of an electric oven, the full effect of the sun's rays and radiant heat as affected by shadows in the oven, is more of a factor than is ordinarily realized. We found variations of from 50 to 80 degrees in the highest grades of electric ovens, as contrasted with 2 to 3 degree variations in the gas ovens, which completely accounted for the lack of uniform results which our Home Service girls claimed with electric ovens as contrasted with gas ovens. Gas ovens rely almost entirely on convected heat and therefore are unaffected by shadow, and "on and off" operation, since they are capable of throttling control. The heat distribution in a modern gas oven is most remarkable, showing only a degree or two variation at any one point in the oven, as well as when compared with any other points in the oven.

Therefore, when talking about modern time-temperature-carefree-cooking, the advantage is all on our side. Electric enthusiasts, basing their experience on old gas ranges, are prone to doubt these claims, but don't let them fool you, a careful study will convince you of the rapid strides made in gas appliances, so that we need have no fear that the gas range in the kitchen is not to the customer's interest, and the economy of operation is all benefit.

In this connection, it is interesting to compare the average costs to the customer by a combination gas and electric service at existing rates with an all electric kitchen, even at the Power Authority subsidized low rates. (See "Economics of Energy Distribution"—1936 A. G. A. Convention). From this we see that the cost is cheaper for the combination service at existing rates. Therefore, we can conclude that our combination gas and electric service is doing a better job already than the Government's hydro program hopes to be able to do with subsidized rates, and in addition develops our social well being, as discussed in this paper. Where then, is anyone being benefited by these Government power programs?

Gas service further involves a complete underground supply to the customer, with all the reliability that goes therewith. Our ability to store gas in holders likewise assures reliability of service, in addition to enabling us to serve the terrifically poor load factor domestic cooking load with a minimum of plant generating investment, as compared with that needed to supply such a load with electricity. Frequently, our plant generating capacity is only one-third the maximum hour sendout, which enables us to take on poor load factor business at a considerable advantage over electricity.

Therefore, *there is a very definite need in this modern America for the two forms of energy distribution*, and the combination company is a sound instrumentality, since there is then less tendency to force either form of energy into markets for which it is not economic, which in the long run is to the interest of the customer and company alike.

Gas Generation Economics:

Now since coal is going to be shipped to market, and combination gas and electric service serves a definite need, we may pause to consider the fundamentals of gas generation and see what the prospects are in this direction.

We have heard much of complete gasification, low temperature carbonization, high temperature gasification, liquefied gases, gasification with oxygen, water gas, back runs, ignition arches, etc. ad infinitum. The main point is—What are the prospects of gas production cost? Since gas can be efficiently converted from coal, and since coal is our most abundant and cheapest form of energy, it follows that gas will probably always be slightly higher in value than coal. There appears no "Aladdin's lamp" on the horizon to make gas cheaper than coal. However, the efficiency of control with gas and its freedom from refuse, and ease of application, will usually enable it to compete with coal for most refined uses.

The only case where gas may tend to be produced more cheaply than coal for equal amounts of energy is where gas is the result of upgrading of fuels, and some of the cost of conversion can be shared by other products, or where the profit on the sale of other products may be returned as a credit. Such a plant is the modern high temperature carbonizing plant, wherein soft coal is used to produce a smokeless, solid fuel, and is thereby upgraded. Likewise, coal in such a plant is upgraded into creosote, tar, pitch, ammonia and the many other by-products. Such a plant, if properly located as regards freight rates and properly balanced with its gas and coke production to fit its available markets can produce remarkably cheap gas. Such a plant ordinarily should not pipe its gas farther than the resultant coke can be carted efficiently by trucks. This is due to the fact that, the coke absorbing capacity of a gas meter is about a balance with the gas demands of that meter, when both are produced in a modern by-product oven. I have seen many cases of unfortunate economics resulting from carbonizing plants expanding for one temporary reason or another beyond this balance. Piping gas over long distances because of a temporary coke market, has resulted later in the need of chasing those long distance gas meters with coke and the resultant loss on freight charges completely upset the favorable economics formerly enjoyed. One other fundamental that a carbonizing plant must consider, if it does ship gas or coke into other than its local markets, it must only do so in the direction of advancing freight rates on coal. Violation of these fundamentals often has created most unfortunate results.

There are many other factors in coal gas operation on a large scale that are capable of development. The dry quenching of coke is a decided economy and produces a superior coke. The distillation of tar into creosote, carbolic oils and pitch by the direct recovery plants utilizing the waste heat of the oven gases, is good economy. Modern plants are now producing sulphur, as a result of liquid purification that gives vastly superior results for spray purposes on fruit trees and is developing a ready market. The utilization of coke breeze as a blend in the coal charged to the ovens and thereby increasing the salable coke from a ton of coal is another recent development. Progress is likewise being made in the reduction of purification costs by the removal of HCN by washing the gas with a solution of sulphur dissolved in ammonia liquor,

(Continued on page 60)

Enthusiasm Prevails at Commercial and Industrial Gas Conference

Strong Program of A. G. A. Hotel, Restaurant and Commercial Sales Conference Brings Out Spontaneous Discussion of Great Value

THE A. G. A. Hotel, Restaurant and Commercial Sales Conference, sponsored jointly by the Industrial Gas Section, American Gas Association, and the Metropolitan Industrial Gas Sales Council, and held at the Commodore Hotel, New York City, May 23-24, will go down as one of the outstanding meetings of commercial and industrial gas men in recent years. More than 175 enthusiastic delegates, from all parts of the country, and representing both manufactured and natural gas utilities, registered. A strong program was presented and the able papers aroused spontaneous discussion which brought out facts and figures of value to all.

The conference was opened by Hale A. Clark, Detroit City Gas Co., Chairman of the Industrial Gas Section, who said a few words of welcome and then introduced Nils T. Sellman, Asst. Vice Pres., Consolidated Edison Co. of New York, Inc., who made the keynote address. Taking as his topic "Gas Fuel in Small Commercial Business." Mr. Sellman briefly enumerated the difficulties encountered in selling this class of customer, retail stores and small commercial establishments.

"Getting 100 cents of the Commercial Cooking Dollar" was the general subject for the forenoon session. This topic was introduced by Alva L. Palmer, The Brooklyn Union Gas Co., and Chairman of the Metropolitan Gas Sales Council, who presided. The first speaker, Harry O. King, Standard Gas Equipment Corp., Boston, delivered an able paper entitled, "Cooking." He stated that when oil as a cooking fuel threatened to be a real competitor, one of the chief factors in its failure was the lack of experience on the part of both manufacturer and seller. Oil salesmen were easily defeated by gas men with superior knowledge of customer needs. He stressed the fact that knowledge of kitchen layout is invaluable to the gas man, as it is eagerly sought by the customer and brought the two close together and usually resulted in a sale. He cited interesting cases of where the gas man, armed with this knowledge had taken orders away from oil coke and electric equipment men.

Calling attention to the necessity of increasing the use of gas in the kitchen, he pointed out that sometimes steam accounted for as much as 30 to 60% of the heat used in cooking and warming. This offers many opportunities for the sake of individual gas fired appliances such as steamers, stock kettles, steam tables, coffee urns, etc.

In a paper on "Baking," by Lawrence R. Foote, Central Illinois Electric & Gas Co., Rockford, Ill., first briefly reviewed the fundamentals as applied to increasing the sales of gas to the retail baker. He then mentioned the trend toward the reel type gas oven saying "how many of you realize that our industry today stands on the threshold of a trend in baking practice which plays directly into our hands and lightens considerably the task of selling the baker.

"French frying is the most abused art in cooking," said Kenneth L. Childs, Vice President, Automatic Food Equipment Co., Inc., Somerville, Mass., in a paper entitled, "Advanced Technique in Fat Frying." "Operators are greatly handicapped," he continued, "due to the lack of proper instructions from equipment manufacturers, shortening manufacturers and purveyors of frying equipment in general. For example there are five outstanding manufacturers of modern high temperature all-vegetable shortening or frying fats. They have done more to improve fried foods than any other contribution to this art because of their superior product, but they upset the apple-cart in frying when they furnished information to the operator. These manufacturers stress the importance of temperature control. In this they are right 100%."

Dealer cooperation was emphasized in a paper, "The Chicago Modernization Campaign," by Thomas J. Gallagher, The Peoples Gas Light & Coke Co., Chicago, Ill.

In discussing dealer cooperation, Mr. Gallagher said, "the dealer is basically in the merchandising business, and basically, we are in the gas business. The dealer must exist on the profits from the merchandise he sells. He is without compulsion or influence, free to sell what he pleases in order to gain this profit. He can not appreciate your position if your selling methods conflict with his attempt to make his bread and butter. In the final analysis, I seriously doubt if many utilities do actually or even expect to realize any profits in their merchandising. The merchandising that we do engage in should consist of 'accommodation selling' to those customers who instinctively prefer to deal with us.

"By no means, should we drop merchandising entirely and leave it in the dealer's lap. But we should encourage him whenever occasion permits to more gas appliance sales by avoidance of direct competition with him on jobs when you can see his chances of getting such business are probably just as good if not better than yours. From my experiences in working with dealers, I can honestly tell you that they do not want us to discontinue merchandising.They realize they need us for inspiration, encouragement, new ideas and knowledge of the many new and improved gas appliances we seek market acceptance for today. Give them this assistance and cooperation, devoid of interference and you will add enthusiastic salesmen to your roster at no expense to you."

Presiding at the Monday afternoon session was Frank H. Trembly, Jr., The Philadelphia Gas Works Co., Vice-Chairman, Industrial Gas Section. Alexander Forward, Man-

Lawrence E. Biemiller, Consolidated Gas Electric Light & Power Co. of Baltimore, chairman, Volume Water Heating Com., Ind. Gas Section, American Gas Assn.; B. F. Reimers, Public Service Elec. & Gas Co. Newark, N. J.; Roy E. Wright, New England Gas and Elec. Assn., Cambridge, Mass., and Harry O. King, Standard Gas Equipment Corp., Boston, Mass.

J. H. Harrigan, Old Colony Gas Co., E. Braintree, Mass., J. S. McElwain. The People's Natural Gas Co., Pittsburgh. B. Catlett, Hartford Gas Co. Kenneth L. Childs, Automatic Food Equipment Co., Inc., Somerville, Mass.

J. F. Healey, Springfield Gas Light Co., Ralph L. Manier, Central New York Power Corp., Syracuse, N. Y., Chairman, Committee on Nominations and George H. Smith, Enyure Gas & Elec. Assn., New York, N. Y.

aging Director, American Gas Association, made a short address of welcome to the assembled delegates. He spoke briefly about the changing selling methods of yesterday, today and tomorrow; how we were all, so to speak, in school all the time learning new and better ways of selling. He paid a fine tribute to the commercial and industrial gas salesmen who went out on the firing line, showed the customers how gas could benefit them and brought back the orders.

"Selling Complete Gas Service to Commercial Customers," was the title of the paper delivered by John S. McElwain, The Peoples Natural Gas Co., Pittsburgh. Mr. McElwain pointed out several fields in which the average gas load could be increased. Among these were tailor shops and candy factories where steam boilers are indicated.

The paper, "Garages and Other Establishments," by Robert D. MacDonald, Consolidated Edison Co. of New York, Inc., was a revelation in the number and diversity of gas-fired appliances that can be sold in these places.

An interesting and comprehensive sales compaign for gas water heaters was described by L. D. McClure, Philadelphia Electric Co. In concluding his paper, "Selling Automatic Gas Water Heating to Commercial Establishments," he made the following interesting observation.

"During this campaign we have found that automatic gas water heaters can be sold almost anywhere in the commercial market.

"Health officers, working jointly with legislative bodies, have brought about the enactment of legislation, requiring the sterilization of utensils, in thirty-seven of the forty-eight states in our country," was a point brought out in a paper entitled, "The Big Field for Sterilizer Business," by Henry M. Finn, President, Hydro-Therm Sterilizer Corp., Boston, Mass. "In the remaining eleven states, although there are no state requirements, many of the cities in these states have enacted Local Ordinance or Regulations requiring sterilization," he said.

"In many of the smaller cities and towns there are local Board of Health rulings, affecting the purveyors of food and beverages. The legislature of the State of New York has just enacted the Rogers Bill which requires sterilization of all eating and drinking utensils, throughout New York State and provides as a penalty for violation, a maximum fine of two thousand dollars or one year's imprisonment or both." He went on to tell about a large soft-drink and light-lunch chain operator, who has 150 stores in New York City and has already equipped 35 of them with gas-fired immersion-type sterilizers, and who is planning to equip all of his stores before the end of the year.

Stating that here is the first real opportunity for new revenue since the advent of the gas refrigerator, he cited the sales in several cities. For instance, Bridgeport, Conn. (pop. 140,000) enacted sterilization regulations and The Bridgeport Gas Light Co., in cooperation with dealers, sold 800 sterilizers in 90 days which added 25,500,000 cu. ft. of gas per year. The gas company in Pittsfield, Mass. (pop. 49,000) in a similar campaign sold 100 sterilizers in 4 months. The gas company in Boston, Mass., with dealers sold 178 in 4 weeks.

Presiding Tuesday forenoon was J. P. Leinroth, Public Service Electric & Gas Co., Newark, N. J., and Chairman of the Advertising Committee. He stated that the topic for that session would be "What's New in Commercial Gas Appliances."

The first paper by Walter G. Groth, United American Bosch Corp., Springfield, Mass., was on Water Heating. The purport of this paper was that there was nothing new in water heating in at least 43 years. To back up this statement, he showed a little book on this subject, written in 1895, which stated that the efficiency of the instantaneous water heater was 71.7%. Quoting from the recent "Final Report of Comparative Water Heater Tests Conducted at the Massachusetts Institute of Technology," he pointed out that today's efficiency was 69.5%, a net loss of 2.2%. In refutation of this, Lawrence E. Biemiller, Consolidated Gas & Electric Light & Power Co., Baltimore, told about the immersion gas water heater developed a few years ago under the auspices of the Volume Water Heating Committee of which he is Chairman. Numerous installations show efficiencies ranging from 75% to 80%," he said.

Lawrence R. Foote, Central Illinois Electric & Gas Co., Rockford, Ill., Chairman, Commercial Cooking & Baking Committee, stated that an immersion gas water heater in his territory had an efficiency of 90%. He made the declaration "to us this looks like the answer to large volume water heating."

"Learn more about the other fellow's job and set up your organization to sell a complete cooking job in the kitchen," was the summation of the remarks of Joseph F. Quinn, The Brooklyn Union Gas Co. and Vice Chairman of the Committee on Conference Program and Arrangements. Speaking on "Cooking" he said that he had books, compiled from all the catalogues of all kitchen equipment manufacturers for his salesmen to carry. Thus equipped they were able to talk intelligently, not only about gas ranges but about any piece of gas-fired equipment that is ever used in the kitchen.

J. F. Healey, Springfield Gas & Electric Co., Springfield, Mass., contributed information about gas laundries in his city. Every piece of equipment except the presses are heated directly with gas burners. A small gas-fired boiler served the press in each case. He cited two hotels and several small commercial laundries thus equipped.

Thomas J. Gallagher, stated that they had had troubles with steam heated mangles of large size. Eugene D. Milener, Secretary, Industrial Gas Section, American Gas Association, declared that recently a new way of successfully heating mangles by the use of forced convection heat, had been developed.

"We in Brooklyn have been casting eyes at 45,000 potential users of some gas-fired refrigeration machine adaptable to the vast majority of commercial applications," said F. C. Neuls, The Brooklyn Union Gas Company, Brooklyn, N. Y., in a paper entitled, "Commercial Gas Refrigeration." He then cited an impressive list of commercial installations made during the past few months. He followed this with a description of the operation of the commercial gas refrigerator unit.

"The baking equipment and supply house is very important to the corner retail bakery," said Clayton S. Cronkright, Public Service Electric & Gas Co., Newark, N. J., in speaking on "Baking." This outlet should be educated and cultivated by the gas industry as the logical way of getting greater acceptance of gas by the retail baker," he said.

In conclusion he petitioned his hearers to "use the information we already have to inform our prospects of the benefits we can offer through the new gas ovens that are available due to the cooperative efforts of the Commercial Cooking and Baking Committee of the A. G. A. and the manufacturers."

Selling Automatic Water Heating To the Low Income Market*

By

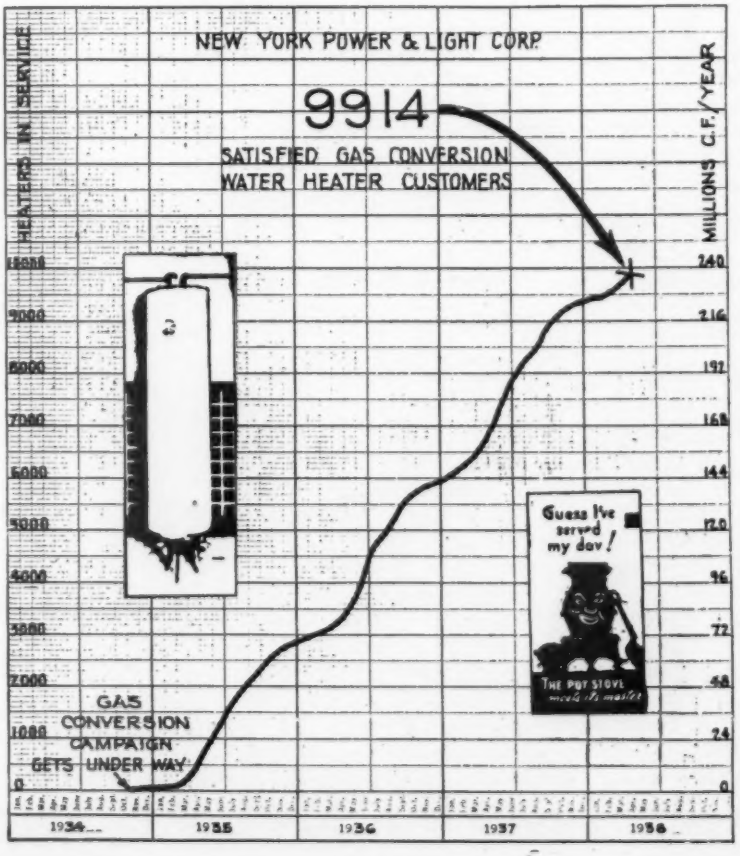
T. W. Halloran

FOR nearly ten years our Company has been interested in the use of low input, high efficiency and slow recovery water heaters. There are many prospects for gas water heating who do not feel that they can afford to use the quick recovery, lower efficiency types of heaters.

When the first conversion type of slow recovery heaters came on the market about 1934, we investigated them and installed enough to give us a good idea of their operation. Over a period of several months, we found that the mechanical service difficulties on these heaters were comparatively small and the operating cost low. The average use was about 2,000 cu.ft. per month.

This investigation built up our confidence to the point that we started a rental sales campaign on these slow recovery conversion heaters in the early months of 1935. This campaign has been carried on continuously and our gross installations over the period of March, 1935 to May 1, 1938, totaled 11,393.

The total reverts on this trial



* *Presented at New York-New Jersey Gas Sales Conference, New York, N. Y., May 19, 1938.*

rental plan have been 1,346, leaving us with 10,047 new water heating customers connected to the lines. We estimate that at least 50% of the removals on this program have been for unavoidable causes, such as deaths, customers moving to new locations, sale of property, etc. We have 117,400 domestic meters and serve 25 communities in a territory 90 miles in one direction and 60 miles in the other. We distribute manufactured gas on the following rate:

	Gross	*Net*
First 615 cu.ft. or less per month	$0.85	$0.75
Next 2,178 cu.ft. per month	1.23	1.16
Next 2,235 cu.ft. per month	1.08	1.01
Next 3,352 cu.ft. per month	.85	.78
Over 8,380 cu.ft. per month	.525	.51

The conversion burner equipment used until recently consisted of a complete installation with tank insulation and pressure temperature relief. This combination has been sold on a rental basis of $1.00 per month for 38 months with customer's satisfaction guaranteed or the burner removed. Thirty and forty gallon assemblies only are included in the program. The maximum hourly gas input of the conversion heaters is 10 cu.ft.

Our sales force consists of 27 men, paid on a salary and commission basis. We have two compensation systems, one with a comparatively high salary and low bonus and the other with a lower base salary and higher bonus. The bonuses on the two systems are as follows:

High Base Salary

Conversion	Factory Built
$1.50	$3.00

Low Base Salary

Conversion	Factory Built
$4.00	$6.00

The two systems have seemed to produce about the same results.

The dealers install all conversion heaters and are paid $12 for each installation. In addition to this, the dealer is paid a sales bonus of $3.00.

All factory built storage water heaters are sold through the dealers and a bonus of $12 is paid to the dealer for each factory built installation. During this program, we have added 2,519 factory built water heaters. This is in addition to the conversion heaters and makes a total of 13,912 automatic water heaters added to the lines over the period of this program.

Photo Courtesy A.G.A.

One of the group pictures taken at the New York-New Jersey Gas Sales Conference. Left to right: R. A. Koehler and John A. Baumgarten, Public Service Electric & Gas Co., Newark, N. J.; J. W. West, American Gas Association, N. Y. C.; Wm. J. Schmidt, Long Island Lighting Co., Mineola, N. Y.; Barrett Andrews, Street Railways Advertising Co., N. Y.; C. A. Kennedy, N. Y. & Richmond Gas Co., Stapleton, S. I. and J. P. Hanlan, Public Service Elec. & Gas Co., Newark, N. J.

Newspaper, direct mail and bill stuffer advertising have been used throughout the campaign. The advertising has featured the convenience of continuous hot water and the low cost with these newer types of water heaters.

Great care was taken during the early part of the campaign to train the salesmen to sell these heaters only in places where they would supply a satisfactory volume of hot water and to acquaint each user with the approximate results to be expected; under no circumstances to oversell.

As previously mentioned, the customer service has been very low as indicated by the number of reverts.

One of the mechanical difficulties encountered during our early experience was stoppage in the coils. This was overcome by the installation of a reverse flushing device which cleared the difficulty except in areas where the lime condition is extreme.

In some areas where there is a large amount of lime in the water, we have found it necessary to use the strap-on type of conversion heater, in which the heat is applied to the tank. This type of heater also gives exceptional results with very little service difficulty.

Our conversion burner rental program has enabled us to sell gas water heating to a large group of people whom we had been unable to reach previously due to the cost of equipment and operating costs. We are well satisfied with the performance of our slow recovery water heaters, both factory built and conversion, we feel that they have enabled us to add domestic load as well as to add greatly to the general promotion of all automatic water heaters.

New Jersey Exhibit of Commercial Appliances

The New Jersey Gas Association for the fifth consecutive year in cooperation with the American Stove Company, Atlantic City Gas Company, The G. S. Blodgett Co., Inc., Detroit-Michigan Stove Company, Radiecon Company and the Standard Gas Equipment Corporation had an extensive display of commercial gas cooking appliances including ranges, broilers, bake ovens, deep fat fryers and counter appliances at the 20th Annual Spring Exposition and Convention of the New Jersey State Hotel Association. The exhibit shown in the accompanying photographs occupied a space 90 feet long. The attractive background was designed by Mr. S. H. Alexander, General Display Representative, and furnished by Public Service Electric and Gas Company.

Over 3,000 hotel, restaurant and club representatives attended the show which was held at the Hotel Ambassador, Atlantic City, New Jersey, April 26-29, 1938. While this number was not as great as in former years, those who did visit the exposition showed considerable interest in new equipment. Nineteen gas appliances were reported as being sold and over 150 prospects for equipment were secured by the various exhibitors of gas equipment.

The cooperative gas exhibit was augmented by separate displays of gas equipment by Nathan Straus, Inc., and J. C. Pitman Company. The cooperative gas exhibit was organized by a special committee of the New Jersey Gas Association under the direction of H. A. Sutton, Secretary-Treasurer of the Association.

New Gas Plant at Owen Sound, Ontario

The Coal Carbonizing Co., St. Louis, Mo. has been awarded a contract to build a gas plant for the municipality at Owen Sound, Ontario. The plant will consist of Curren-Knowles by-product recovery coke ovens and auxiliary apparatus. The Coal Carbonizing Co. is licensed to build these ovens by H. A. Brassert Co., Chicago, Ill.

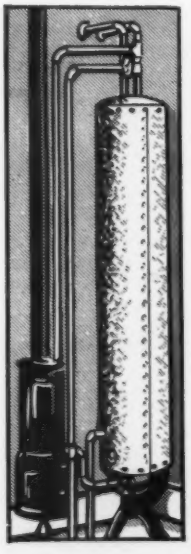
IS WHAT USERS ARE SAYING ABOUT

HOT WATER

FROM MIRRO-SHELL CONVERSION GAS WATER HEATERS

PLACING A MIRRO-SHELL AROUND THE CUSTOMER'S PRESENT TANK MAKES IT INTO AN AUTOMATIC HEATER AT A PRICE HE CAN AFFORD

MIRRO-SHELL'S new principle of heating water by reflection is highly efficient and thousands of users are telling their friends about its low monthly operating cost.



Before

Heating Element and Insulation Combined. One Complete Unit At Low First Cost. 24 Gauge Steel Jacket. Ivory and Green Finish. No Liming, Sediment or Circulating Troubles. Quickly Installed By One Man.

Made With Inputs From 4,500 to 10,000 B.t.u. Per Hour For Both 30 And 40 Gallon Tanks. For Use With All Gases.

By assembling Mirro-Shell upon new tanks, dependable and fine appearing automatic heaters can be had for an attractive price.

FOR DETAILS WRITE

HANDLEY-BROWN HEATER CO.

JACKSON, MICHIGAN

After

WHAT? A WHITE HEAVY DUTY GAS RANGE?

No, but as far as the cleanability of the Magic Chef is concerned it might as well be white!

● For many practical reasons, Magic Chef Heavy Duty Gas Ranges are made in black-exterior finish. But, into Magic Chef are built many exclusive features making for thorough, easy cleaning. Your Magic Chef installation can be as spotless—inside and out—after years of service, as it was the day it first brought greater cooking efficiency and economy into your kitchen.

AMERICAN STOVE COMPANY

Boston • New York • Atlanta • Cleveland • Chicago
St. Louis • Philadelphia • San Francisco • Los Angeles

Phone or write our nearest branch, and let us show all the features which make Magic Chef the easiest to clean as well as the most economical and efficient.

Complete and Flexible Line of Ranges, Roasters, Broilers, Bakers

LOOK FOR THE RED WHEEL WHEN YOU BUY A MAGIC CHEF

Beyond the gas mains use Pyrofax tank gas (East of Rockies)

GAS IS YOUR QUICK, CLEAN, ECONOMICAL SERVANT

Magic Chef
AMERICAN STOVE COMPANY

Three of the exclusive Magic Chef features that promote greater cleanliness and efficiency

Sanitary Burner Trays for Grate Tops are extra deep, to catch boilovers. The entire tray and burner is easily removed for thorough cleaning. Burners cannot clog because port openings are on side, and boilovers run past into tray.

Sanitary Burner Trays for Hot Tops are directly under lid and ring seams—one under each joint. Burners and flue passages will not clog, because boilovers and grease seeping through are caught in these trays, which are easily removed for cleaning.

Sanitary Coved Rim at back edge of burner top prevents seepage into the flue box, and makes cleaning much easier. Clogging of flues, and odors from greasy deposits are eliminated in the Magic Chef. Oven bottoms also have this coved rim around edges, keeping spillovers from combustion chamber.

Association of Gas Appliance and Equipment Manufacturers' Annual Convention

MERRILL N. DAVIS
President

The Association of Gas Appliance and Equipment Manufacturers held its Annual Convention at White Sulphur Springs, W. Va., May 25-27. Merrill N. Davis, Bradford, Pa., President of the Association, in his opening address urged greater sales effort toward the replacement of obsolete equipment in homes everywhere as a means of opening up a wide selling market, of giving industry a strong normal stimulus, and making possible a great saving for those investing in modern, efficient appliances. He said "By proving to our customers throughout the nation that obsolete appliances are costly, and that modern devices will save them a substantial amount of money and make their daily living more comfortable, a market can be widely developed."

Emphasizing the importance of adequate advertising and continuous promotional efforts, Mr. Davis stated: "The public is becoming aware of the fact that gas is a thoroughly modern fuel when modern equipment and appliances are utilized. To sell more appliances we must not only continue our present policy of advertising but we must increase the amount being done and use the best mediums available. The greatest need in the gas industry today is an aggressive offense and the best way of insuring our growth and development is use of sound, courageous promotional plans."

C. W. BERGHORN
Secretary

Nine million homes using unmodern, uneconomical gas ranges offer challenge to both manufacturer and retailer, George T. Stevens of the Allied Purchasing Corp., New York, told the Association. He stated that "Changing consumer demands and buying standards can and must be accomplished. Department stores with manufacturers and utilities cooperating can be a most important force. Department store customers include all income classes and their promotion and sales plans must be comprehensive. Success depends on having what the customer wants when she wants it and at the price she wants to pay. However, there can exist tremendous influence on all three of these phases and we are quite anxious to do so when improvement of industry will result."

Hugh H. Cuthrell, Vice President Brooklyn Union Gas Co., Brooklyn, N. Y., stated "Challenges haunting the gas industry today are better public relations, a greater investment during the next two or three years in promotion and advertising, a fuel that will fulfill claims made that it is the most flexible fuel, and the most completely automatic appliances scientifically possible. We are quick to say that the customer is always right, but we don't always do something about it," Mr. Cuthrell said. "There isn't a man in the industry who begins to know as much about public relations and what the public wants, as he should. We have got to learn a lot more about public relations before we can even start to meet the needs of today to say nothing of the world of tomorrow."

Plans for manufacturers and utilities to market a special gas range, the result of a year's scientific research by engineers, technicians and sales engineers of the gas industry, were received enthusiastically by manufacturers of various divisions of the Association.

W. E. Derwent, Rockford, Ill., chairman of the Domestic Gas Range Division of the A.G.A.E.M., in describing this "gas range of tomorrow" to be symbolized by the letters "C. P." told the delegates that twelve manufacturers had already accepted the "CP" gas range specifications for use in early manufacture. Mr. Derwent said that arrangements were being made for a national promotion campaign by the Association to bring the "CP" standards of gas range manufacture before utilities and other outlets as well as the consuming public.

In developing the highest standards of efficiency for a gas range that any manufacturer might build and market, N. C. McGowen, of Shreveport, La., president of the American Gas Association, said: "I think the gas industry is making a forward step in this 'CP' gas range."

R. S. Agee, sales promotion manager of the A.G.A.E.M., said that the special committee which had worked out specifications for the "CP" gas range, after careful research and consumer surveys, had decided upon more than a score of points which they felt if applied in range construction will more than satisfy home-makers of today and tomorrow.

Foremost among matters discussed during the convention of the Association of Gas Appliance and Equipment Manufacturers was the launching of the new "CP" Range Program. Among those who attended and participated in the special meeting of the Domestic Gas Range Division held on the second day of the gathering were (reading from left to right): SEATED—R. M. Leach of the Glenwood Stove Co.; Hugh H. Cuthrell, vice-president, Brooklyn Union Gas Company and president of Gas Exhibits, Inc.; Lucian Kahn of the Estate Stove Co.; W. E. Derwent, chairman of the Division and vice-president of the George D. Roper Corp.; T. T. Taylor, general sales manager, Roberts and Mander Stove Co.; Keith Miller of the Tappan Stove Co.; W. H. Frick, of the American Stove Co.; STANDING—L. Rodauch of the Glenwood Range Co.; Alden Chester, vice-president, Globe American Corp.; A. E. Lindquist of "Gas Age"; E. R. Guyer, vice-president, Cribben & Sexton Co.; Frank Roberts, president, Standard Gas Equipment Corp.; A. P. Tappan, vice-president, Tappan Stove Co.; I. W. Peffly, vice-president, American Stove Company; I. V. Brumbaugh of the American Stove Company; J. H. Moore of the Robbins Publishing Co.; and R. S. Agee, sales promotion manager for the A.G.A.E.M.

Use LAVINO "ACTIVATED" OXIDE ...save the difference!

Initial cost is no higher . . . yet it saves on cost of handling . . . will cut your gas purifying costs by removing a greater amount of H_2S— and by purifying a greater number of cubic feet of gas per pound of oxide!

Substantial proofs of these truths are available for your inspection. And your inquiry does not obligate you in any way.

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Without obligation, tell me how Lavino "Activated" Oxide will save me money.

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All sizes up to 3,400 cu. ft. capacity

Meters
Diaphragms
Repairs
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Calorimeters
Wet Meters
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Apparatus

METER REPAIR PARTS

FOR

ALL MAKES — ALL SIZES OF METERS

LARGEST GAS COMPANIES NOW USING OUR PARTS

SEND FOR OUR CIRCULAR ON METER REPAIR PARTS

SAMPLES AND PRICES GLADLY SENT

— 0 —

LAMBERT METER CO.

BUSH TERM. BLDG. 4, BROOKLYN, N. Y.

There's a Reynolds Regulator for every Gas Control Requirement

For nearly half a century REYNOLDS Gas Regulators have proved their ability in a field outstanding for its rigid requirements.

Proper regulation at the station, in the line, in industrial plants, in the home—for every kind and type of pressure control equipment used in the gas industry, there is an especially designed product by REYNOLDS that will give satisfactory control limits, capacity range and economical operation over a long period of time.

REYNOLDS PRODUCTS

- High Pressure Service House Regulators
  Straight Lever Type—Models 0-10-20 Series
  Toggle Lever Type—Model 30 Series
- Low Pressure Service or Appliance Regulators
- District Station Regulators
  Single or Double Valve, Auxiliary Bowl and Automatic Leading Device Optional
- High Pressure Line Regulators
  Pilot-Loaded, Pilot Controlled
- Toggle Type Regulators
  Single Valve, Double Valve, Triple Outlet
- Seals
  Dead Weight or Mercury
- Relief Valves
  High or Low Pressure
- Back Pressure Valves
- Automatic Quick Closing Anti-Vacuum Valves
- Automatic Shut-Off Valves
- Lever Operated Valves
- Louver Operated Device
- Atmospheric Regulators
- Vacuum Regulators

REYNOLDS GAS REGULATOR CO.
Anderson, Indiana, U. S. A.

Gas Control Since 1892

Flow Characteristics, Composition, and Some Liquid-Phase Properties of Hydrocarbon Fluids From a "Combination" Well[1]

By C. K. Eilerts[2] and M. A. Schellhardt[3]

The report is limited to preliminary results of field and laboratory tests on one well in one field; therefore, general statements and conclusions regarding high-pressure "combination" wells are not justified. Although the results of the present study are subject to verification by additional field and laboratory work, it is believed that the conclusions herein presented apply reliably to well **M**, which has been studied.

Ratios of gas to hydrocarbon liquid, pressures, and temperatures within the well and the surface-recovery system and other well-flow data were observed over a considerable range of operating conditions in the well. Gas and liquid samples from the high-pressure separator and liquid samples from the well bore and stock tank were obtained for laboratory study to determine fluid-phase relations in the reservoir and recovery system.

The results of the field and laboratory work described in the foregoing sections of this report indicate the following conclusions.

1. Comparisons of ratios of gas to hydrocarbon liquid obtained under different rates of fluid recovery did not indicate conclusively the phase relations in the reservoir.

2. Pressure data on the flowing well showed that liquid and gas were present simultaneously in the well bore.

3. The composition of the subsurface liquid sample, which had a saturation pressure within 200 pounds per square inch of formation pressure, as compared with the compositions of surface liquid samples having much lower saturation pressures, does not indicate that the liquid likely would be formed entirely by condensation as a result of the 200 pounds per square inch decrease in pressure.

4. Restoration of the saturation pressure of the subsurface sample to the value of the formation pressure by the addition of the amount of gas likely to be liberated by a drop of pressure of 200 pounds per square inch did not prevent it from remaining in the liquid phase at formation pressure and temperature. It is concluded, therefore, that part of the liquid recovered from the well was present in the reservoir in the liquid phase, and the remainder was formed during the process of production by condensation of heavy components from the original reservoir vapor phase.

Manufacture of High B.T.U. Water Gas

(Continued from page 34)

which appear suitable for making the type of gas under consideration.

The observations made did not seem to indicate that the heat-up cycle had any particular merits as far as the production of 800 B.t.u. gas was concerned, although, since this heat-up cycle would tend to dampen out temperature fluctuations it may be distinctly valuable when making a 1000 B.t.u. gas involving the use of still greater quantities of oil per cycle. There are, of course, other methods of operation available to the experimenter and the one which occurs immediately is the introduction of steam into the carburettor together with the oil, with the possibility of performing a measurable degree of methane synthesis. As far as could be told, whatever methane was produced during the test period originated from pyrolysis only. The addition of steam into the carburettor is indicated when it is considered, that whereas normally a large amount of undecomposed steam passes through the generator, in this case, when making only small proportions of blue gas and using small quantities of steam per cycle, very high generator temperatures are encountered with the result that steam decomposition is carried far beyond the normal ratio. No definite statements in regard to this method of operation can be made since it was not tried out during the test period, but it appears to merit a trial.

It will be recalled that in the Semet-Solvay Reverse Flow water gas machine, the blue gas is introduced at the base of the carburettor whereas the oil is injected into the top. In spite of the abnormally large quantities of oil used, distillation of the oil was apparently completed in the carburettor as no accumulations were found in the base except when undue quantities of oil were used during the early runs of a day after a long shut-down and before the carburettor had been properly brought to temperature. This counter current flow of gas and oil results in an action which may be termed distillation in suspension, and appears to have several very desirable results.

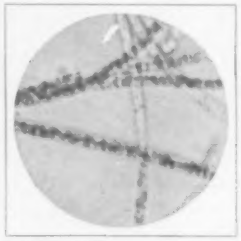
It appears to prevent the over-cracking of the lighter parts of the oil and avoids the formation of naphthalene, of which not more than the merest trace was found in the gas.

In conclusion it should be said that the production of high B.t.u. gas of specific characteristics is not an easy matter. Neither this set nor any other piece of equipment with which the writer is familiar will produce the desired results in the hands of careless and unskilled personnel, but the tests indicate that the Reverse Flow Set is an excellent tool in the hands of a skilled operator.

Beggiatoa

THE SMALLEST PURIFICATION PLANT IN THE WORLD

Gaze into the microscope! There is the bacterium *Beggiatoa,* one-half millimeter in length, the smallest purification plant in the world. It dwells in dank and stagnant ponds where rotting vegetation evolves hydrogen sulphide. *Beggiatoa* absorbs the hydrogen sulphide, leaving granules of pure sulphur deposited in its protoplasm to be oxidized and used as a source of energy when needed. Having utilized the sulphur, *Beggiatoa* passes off sulphuric acid as a waste product. We who have spent nineteen active years specializing in dependable, economical purification and building up the *largest* purification plant in the world marvel at the efficiency of this tiny unit of the microscopic universe.



Beggiatoa 250 x

GAS PURIFYING MATERIALS CO.
L. I. City, N. Y. and Providence, R. I.

GPM
IRON HYDROXIDE

Food For Thought

1. 20,000 miles of mains surveyed.

2. 14,000 new gas leaks located.

3. 40,000 valuable reports made on trees and shrubs.

4. 150 companies using the service.

5. Enough savings in unaccounted for gas to pay the bill.

6. A trial will convince you.

May we hear from you?

New England Forestry Service Inc.
75 Federal St., Boston, Mass.

GAS SERVICE STOPS

SINCE 1869 Hays has built dependable brass products for the Gas Industry. Standard, Special Weight, Heavy Pattern and High Pressure Stops to meet all requirements are manufactured by Hays in a full range of sizes. Write for Catalog No. 4 today.

HAYS MANUFACTURING CO. ERIE, PA.

CRUSE-KEMPER COMPANY

STEEL PLATE CONSTRUCTION

AMBLER, PA.

GAS HOLDERS

HOLDER INSPECTION

RIVETED OR WELDED FABRICATION & ERECTION

TANKS, BINS, FLUES PURIFIERS, WELDINGS

glover-west

continuous verticals

The logical plant where maximum gas yield and coke of high reactivity are required. The high thermal efficiency, low operating cost, extreme flexibility to meet variations in daily output, and freedom from naphthalene in finished gas have made this process the choice of experienced operators all over the world.

•

The proven reliability of Glover-West continuous verticals makes their adoption well worthy of consideration in any scheme of planning for the future.

•

We place at your disposal the experience gained in over 400 installations now operating in all countries of the world and under widely varying conditions, augmented by the resources of modern research and a worldwide organization.

•

WEST GAS IMPROVEMENT CO.

424 Madison Avenue New York City

THE GOODMAN STOPPER

The Reliable Shut-Off for Street Mains

Equipped with Improved Patented Locking Sleeve, which locks both handles to the pipe. Stopper cannot slip. Gas cannot pass.

Safety Gas Main Stopper Co.

523 Atlantic Avenue, Brooklyn, New York

IRON SPONGE "Stands Up"

Striking comparison between ordinary wood shavings (left) and Connelly selected wood filler (right), as used in IRON SPONGE — the ideal gas purification material. Note how Connelly selected wood filler resists compression or "packing down." Write for Bulletin No. 100-B-1.

Connelly Iron Sponge & Governor Co.

Chicago, Ill. Elizabeth, N. J.

HEATING BUNKER "C" OIL

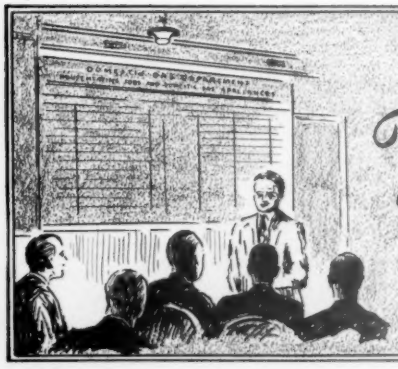
for carburetting gas requires high pressure and high temperature.

ANDALE BOWED TUBE HEATERS

remain tight and are easily cleaned. These are the requirements for continuous satisfactory operation.

ANDALE COMPANY

1600 ARCH STREET
PHILADELPHIA



Timely Sales Chats

By William H. Matlack

Someone is buying something from someone all the time. Depressions and repressions call for a lot more bird dogging we'll admit, yet even now, when thousands are grumbling there are salesmen who are nosing out orders (cartoon) * * The Janatrol folks have just released one of the biggest, in point of size and potent promotion, pieces (from a miniature folder to some window streamers with all the things inbetween that make the heart of an ad-promotion-man go pitty pat) we've ever seen. We hand them a posey.

El Hollingsworth, Roper ad-man has just produced a whopper of a campaign plan to sell gas ranges that he calls "Summer Sales Stimulator, a Swingtime Sale." It's full of ideas which may be used as is or revamped. * * A piece in the May issue of the U.G.I. Circle by Tom Scully contains an item to the effect that the average American eats "one meal of every three in a commercial institution, or industrial food service establishment." The item is interesting as it provokes the question: What is the gas man doing to get his share of this profitable load?

Last month we had something to say about the number of gas companies that are using "Trial Plans" for the sale of automatic GAS water heaters, the movement has taken on and we understand it is being successfully operated in a number of instances. This is particularly true where the sale is predicated on a survey of the customer's hot water needs.

The survey is a very effective sales tool not only for selling gas automatic hot water service but for selling home heating. The Consolidated Edison Company of New York for instance is using a plan of this kind and using big space to tell the story of "Knowing the cost of fuel" for home heating in advance as may be seen by the advertisement reproduced.

Original Newspaper Mat 12 x 12.

NOW YOU CAN KNOW THE COST OF FUEL AND EQUIPMENT before YOU BUY
GAS HEATING
FOR YOUR HOME
FIXED MONTHLY PAYMENT COVERS BOTH!
CONSOLIDATED EDISON'S
Gas Heating Installation Budget Plan combines lowest price for equipment with low fuel costs. Install
GAS HEATING
the only completely automatic system at LOWEST installed price ever offered in New York
SO simple . . . so sensible . . . never done before! With this revolutionary payment plan, you can now enjoy all the comfort of heating with gas—the only completely automatic house-heating fuel—and budget the cost exactly! A study of your heating needs by Consolidated Edison will show you—before you buy—how little it costs each month. The amount is pre-determined, under our Gas Heating Installation Budget Plan.
Combined with this new plan is the lowest price ever offered in New York for any similar automatic heating equipment. And gas rates are lower than ever, too!
25% TRADE-IN ALLOWANCE for your old furnace, if it is not possible to install a Janitrol conversion burner in it. This generous allowance will help you buy a complete new automatic gas furnace or boiler.
Special features in this advertisement available only to our gas customers. We supply Manhattan, Bronx, Westchester, and parts of Queens.
Only $179.50 CASH PRICE
COMPLETE AND INSTALLED OR
3 YEARS TO PAY
(The small finance charge will be waived if you decide to pay in full at any time within the first 15 months.)
Standard Janitrol Gas Burner equipped with electric clock thermostat. Last year's price was $200.
30% SAVING ON JOHNS-MANVILLE ROCK WOOL HOME INSULATION . . .
Special low prices available to all our customers who use gas for house-heating. Made and installed by Johns-Manville. Makes your home more comfortable all year round. Saves up to 25% on fuel bills.
FREE SURVEY AND ESTIMATE . . . to show you how little it will cost to switch over to modern automatic gas heating. Send the coupon to have our representative make a study of your heating requirements. No cost or obligation.
MAIL THIS COUPON TODAY! ACT NOW!
Name
Address
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
TUNE IN WEAF EVERY FRIDAY, 7:30 P. M.—"New York on Parade"

BELIEVE ME! BY RADIO'S FAMOUS MYSTERY CHEF
TO KEEP THE CREAM PITCHER FROM DRIPPING — SPREAD A TINY DAB OF BUTTER ON THE TIP OF THE SPOUT
Seeing is Believing!
WITH THE NEW GAS RANGES CAKES BAKE EVENLY ON EITHER THE HIGH OR LOW SHELF OF THE OVEN. SEE THEM AT YOUR RANGE DEALER'S AND FIND OUT ABOUT LOW PRICES!
TO CUT BREAD THIN FOR PARTY SANDWICHES HEAT BLADE OF KNIFE IN BOILING WATER AND DRY. CUT WITH HOT BLADE!
YOU GET YOUR MONEY BACK QUICK WITH A MODERN GAS RANGE. NEW STYLE BURNERS SAVE FUEL. MEALS ARE COOKED BETTER AND IN LESS TIME
NEW YORK POWER AND LIGHT

* * New York Power and Light goes "almost Ripley" in a series of what we call very effective gas range advertisements * * Mid-western gas companies; Laclede Gas Light Company, St. Louis County Gas Company and Illinois Iowa Power Company started a big drive for the sale of Gas Hot Water Service on May the first. The activity 'tis said is planned for an intensive "survey sale" of automatic gas water heaters with a follow up that will last a couple of months more. Advertising in newspapers has a tie-in with direct mail, posters and store and window display advertising * * In the east the Consolidated Edison Company of New York is also out to sell gas hot water service using the "Free Survey" plan. See opposite page.

The Gas Service Company staged a Gas Range Derby during May and to start the activity off in a fine way thirty percent of the campaign quota of 1675 Gas Ranges were sold during the first two weeks * * Who says the gas range business is down * * Don't talk conditions. It's bad enough to think about them and that should also be done with less frequency.

Never look at the hole, look at the doughnut, for that's where you get the dough * * The Public Service Company of Northern Illinois features Automatic Gas Water Heaters on their May calendar-house organ and like so many other gas companies they are offering a free Trial in the home plan.

H. R. Sterrett of the New Haven Gas Light Company points out in the same issue of the "Circle" that: "Today, the gas industry serves nearly 16 million customers . . . has assets of nearly 5 billion dollars . . . employes more than 135 thousand persons" and has sold enough GAS refrigerators during the past ten years to give the gas industry an annual added domestic load of about 19 million cubic feet. There's something else to think about—GAS refrigerators have been accepted and they are mighty fine load builders, an appliance that we should get behind.

They are doing it in Harrisburg, Pa., where the gas company recently installed 98 in one apartment (photo).

The U. G. I. companies are under way with an "Eight-months Employee Campaign" to boom The All Gas-Home.

It begins to appear that the gas man has come to the realization that the time to use heavy promotion and do the most plugging and door-bell pushing is when business "is where you develop it" and then "go out and get it". In the past, strange as it may seem, the time to get a few dimes for advertising and sales promotion, and to get the "mostest" of them, was when business was walking into the stores or 'phoning for a representative to call and book an order.

This Swing is also being taken up by the manufacturers of appliances. They are doing a sweet job of promoting usage along with their own trade marked lines, in the popular periodicals and in many of the metropolitan newspapers.

Monel is also in on the promotion and as time goes on we understand the list of national advertisers will grow * * That's going to help—continuity and plenty of copy in newspapers and magazines, in store and window display advertising, and chatter over the air will get the gas industry going places, and how.

The Cincinnati Gas and Electric Company use a "Cooperative Creation" to feature the value of Hot Water Service in the home with a clever cartoon type display and two window cards the one to the right names nine different heaters that the company recommend.

9 Different makes of Water Heaters are recommended on the display card to the right of the cartoon.

People's Gas Light and Coke Company, Chicago are presenting folks of the windy city with some timely and well produced booklets to promote the use of GAS for home heating, cooking and refrigeration these days. The booklets are entitled: "People's Gas Presents 3 Homes", "Let's Get Down To Cases" and "A Thousand Hours." Perhaps you may persuade the advertising department to mail you copies, if you are interested.

** *The Gas Service Company, Kansas City, is offering a ten-quart whole meal aluminum cooker free with a Magic Chef gas range.*

News of the Industry

Indiana Gas Assn. Meeting

With 450 representatives of Hoosier gas companies in attendance at the twenty-eighth annual convention of the Indiana Gas Association at Gary, May 16 and 17, the association held its most successful assembly in its history.

Dean H. Mitchell, Hammond, vice-president and general manager of the Northern Indiana Public Service Company, was elected president of the association, succeeding H. Carl Wolf, Muncie, president of the Central Indiana Gas Company. Paul A. McLeod, New Castle, of the Public Service Company of Indiana, was named vice-president, succeeding Mr. Mitchell in that office. For many years, Mr. McLeod had been secretary-treasurer of the association. The new secretary-treasurer is H. Wayne Thornburg, Anderson, of the Central Indiana Gas Company. Directors for 1938-39 are Louis B. Schiesz, Indianapolis, vice-president and general manager of the Northern Indiana Power Company; H. G. Armstrong, Terre Haute, of the Indiana Gas Utilities, and A. V. Grief, vice-president and general manager of the Gary Heat, Light & Water Company.

The utility men and their wives heard L. L. Bomberger, president of the Indiana State Bar Association, talk on "this meddling with private industry stirred by political motives" at the annual banquet. Other speakers on the well-rounded program discussed employe education, service and public relations, accounting problems, the certified performance range, and other industry problems.

Gas at National Home Show

Thousands of prospective home owners viewed the gas exhibit at the fifth annual Long Island National Home Show held from April 30 to May 7, inclusive, in the new Jamaica Armory on 168th Street just off Jamaica Avenue, Jamaica, N. Y.

Fourteen gas appliance manufacturers cooperated with The Brooklyn Union Gas Company in the exhibit. The gas exhibit dominated the show because of its attractive design, its compelling size and its strategic position in the armory.

The gas exhibit, which was similar in theme to the New York World's Fair of 1939, occupied 3,600 square feet of space in the armory, directly facing the information booth. In the foreground, rising to a height of 41 feet, was an imposing tower, bathed in floodlights, and flanked on either side by the word GAS, in large block letters about six feet high.

By visiting the fair prospective home owners saw the latest designs in modern gas appliances and learned how gas contributes inexpensively to the comfort of the modern home. They also obtained an idea of why gas has been selected over other fuels by the World's Fair in pursuit of its theme—"Building the World of Tomorrow."

In addition to the exhibit The Brooklyn Union Gas Company presented two cookery demonstrations in the armory's gun room. At the afternoon session a slide film, with sound, was also shown. In the evening a skit, "The Bride Steps Out," was presented.

Cooperating with The Brooklyn Union Gas Company were the manufacturers of the following gas appliances: Ranges—Estate, Magic Chef, Quality, Roper, Tappan and Universal. Refrigerator—Electrolux. Water Heaters—American Bosch, Penfield, Rex and Ruud. House Heaters — A.G.P., Bryant and Janitrol.

CONVENTION CALENDAR

June

9-10 *Canadian Gas Association*, Annual Convention, Royal York Hotel, Toronto. (No exhibits.) G. W. Allen, Secretary - Treasurer, Astley Avenue, Toronto, 5.

16-17 *Pacific Coast Gas Association*. Northwest Conference, Portland, Oregon.

23-24 *New England Gas Association*, Sales Conference, Viking Hotel, Newport, R. I.

July

1-2 *Michigan Gas Association*, Mackinac Island.

September

14-16 *Pacific Coast Gas Association*, Annual Convention, Santa Barbara, Calif.

October

10-14 *American Gas Association*, Annual Convention, Atlantic City. (No exhibits.)

Consolidated Edison Co. Exhibit At New York World's Fair 1939

The world's largest diorama, a colored, lighted, animated architectural model of New York's Metropolitan Area, is to be presented at the New York World's Fair 1939 as the principal exhibit by the Consolidated Edison Company of New York, Inc., and affiliated companies, it is announced by Grover A. Whalen, President of the Fair Corporation, and Floyd L. Carlisle, Chairman of the Edison Company's Board.

More than 4,000 buildings, studded with 130,000 windows, will be shown in the diorama, whose 204,000-watt illumination will require the most extensive model wiring job on record. Nearly a quarter mile of brilliantly colored neon tubing will represent the city's underground electric, gas and steam networks, while the most complete model subway system yet devised, with trains designed for a "World's Fair run" of 35,000 miles, are to provide transportation highlights for the exhibit. Translucent generating station models will suggest the transformation of coal into electricity, gas and steam.

The diorama will be presented with sound effects in cycles dramatizing the contributions of electricity, gas and steam to life in New York. Each performance will crowd into a cycle of twelve minutes the dramatic features of a twenty-four hour period in the metropolis.

Midwest Industrial Gas Sales Council Holds Meeting

An enthusiastic meeting was held by the Midwest Industrial Gas Sales Council of the Industrial Gas Section, American Gas Association, at the Indianapolis Athletic Club, Indianapolis, Ind., May 24-25. It was well attended by both natural and manufactured gas men.

The following educative and informative papers were given: "The Application of Gas as a Medium for Heat Treating and Forging Steel in the Saw Industry" by R. L. Fitzsimmons of E. C. Atkins & Co., Indianapolis; "Gas Carburizing in Batch Type Furnaces" by Harry O. Bennett, The Surface Combustion Corp.; "The Possibilities of Dowtherm and Its Proper Application," by E. E. Magnuson, Eclipse Fuel Engineering Co., Rockford, Ill. and "Insulating Material and Its Application," by T. A. McGee, Vice-President, Insulating Products Co., Aurora, Ill. These papers were followed, on both days, by round table discussion.

Officers for the 1938-39 season are as follows: Arthur J. Huegel, Chairman, Milwaukee Gas Light Co., Milwaukee, Wis., Rodney C. Haylor, Vice Chairman, Central Indiana Gas Co., Muncie, Ind. and P. F. Gibson, Secretary and Treasurer, Western United Gas & Electric Co., Aurora, Ill. The Program Committee has for Chairman William M. Riach, Jr., The Peoples Gas Light & Coke Co., Chicago; James Dare, Public Service Company of Northern Illinois, Streator, Ill., is Chairman of the Luminous Flame Committee.

In its new Beverly Hills store, Saks Fifth Avenue was careful to provide every feature that could possibly add to the comfort of a distinguished clientele . . . a brilliant exterior, the finest of fixtures and furnishings, the exclusive merchandise which is a Saks tradition . . . and of course, PAYNEHEAT.

In fine buildings and homes everywhere, Payneheat, through its efficiency and economy, is constantly proving the wisdom of specifying GAS.

Made in America's most modern furnace plant, Payne Furnaces are the magnificent result of 25 years concentration on gas-fired appliances exclusively.

Payne
FURNACE & SUPPLY CO., INC.
BEVERLY HILLS • CALIFORNIA

THE IDEAL FUEL GAS

DO ALL YOUR CUSTOMERS BUY TWELVE DOLLAR HATS?

Isn't it just as reasonable to suppose that your customer who pays three dollars for a hat might buy automatic water heating service of a different type than your twelve dollar customer?

The Republic LO-BILL conversion water heater was designed for your three dollar customer. It fits both his pocket-book and his budget.

The LO-BILL record of load-building at least warrants your careful investigation.

The LO-BILL is just the item to put new life into that water-heating program of yours.

Write today for proof. We have it.

Remember - - - -

ALL your customers wear hats.

AUTOGAS CORPORATION
Chicago Illinois

Republic Heaters Sales Company
General Sales Agent
Chicago Illinois

L. W. Childress Elected President Laclede Gas Co.

L. Wade Childress, chairman of the board of the Columbia Terminals Co., and a director of the Laclede Gas Light Co., has been elected president of the Laclede Gas Light Company to succeed Joseph B. Wilson, who resigned.

Following his election, Mr. Childress, who is serving his second year on the Laclede board, issued a statement in which he said it was planned to increase the company's facilities "to provide an attractive price for all our products and to make every customer realize we have a concern in his way of looking at our service."

William C. D'Arcy, president of the D'Arcy Advertising Co., was elected to be a member of the executive committee of the board.

Other officers of the company re-elected were: B. F. Pickard, vice-president; Edward L. White, secretary-treasurer; and Alfred Hirsh, assistant secretary-treasurer.

Coast Counties Gas Appointments

R. L. Nance has been appointed to fill the newly created position of Service Supervisor for the Coast Counties Gas and Electric Company, according to H. L. Farrar, president of that organization. Mr. Nance will make his headquarters in Santa Cruz, and his activities will include the entire service area of that company, extending from Imperial Vally in the south to Dunsmuir, Yreka and Arcata in the north.

E. B. Mason, Jr., replaces Nance as District Manager in the Imperial Valley Division of Coast Counties Gas and Electric Company, with headquarters at El Centro, where he will be in charge of all commercial and sales activities.

Curtis Young has been transferred from the Watsonville District to Imperial Valley as District Gas Foreman and will be in charge of gas operations there.

These changes meet the need for direct service supervision to more closely tie this work and the sales department activities together and give greater coordination of departments.

Catalog of Technical Books

The 150-page spiral bound Catalog No. 5 listing and describing chemical, bacteriological, pharmaceutical, medical, engineering, electrical and general scientific and other technical books of all American and British publishers, offered to technical workers by the Chemical Publishing Co. of New York, Inc., met with such a great demand that it is now out of print. Catalog No. 6 is now ready and will be mailed to any chemist, engineer, scientist or professor sending 10 cents in stamps or coin to cover mailing.

This catalog eliminates the necessity of filing and looking through catalogs of many technical publishers—thus saving a great deal of time and effort.

Gas Refrigeration in March

Sales made during March in a nationwide gas refrigeration selling campaign conducted by the American Gas Association Refrigeration Committee were greater in number than those of a similar campaign in March a year ago, according to an announcement made by H. R. Sterrett, president of the New Haven (Conn.) Gas Light Company, chairman of the Committee from its headquarters in the Graybar Building, New York City. Mr. Sterrett also reported that the number of salesmen throughout the nation who won awards in the contest was considerably greater in March, 1938, than in March, 1937.

"The March results are significant in view of the fact that it has been said that sales are harder to make this year," Mr. Sterrett stated. "Furthermore, March is not usually considered a favorable month for making big refrigerator sales, as that month precedes the regular summer selling season."

Salesmen who won awards in March, 1938, numbered 323 as against 262 winners in the same month in 1937, the announcement said.

This and coming campaigns are sponsored by Servel, Inc., through the Association of Gas Appliance and Equipment Manufacturers.

Sings the Praises of Electrolux

In the picture herewith is the famous singing star, Jessica Dragonette, whose lovely voice has made her popular with millions of radio listeners and concert-goers throughout the land. She is now delighting audiences all over the country with her singing. One of her favorite hobbies when at her home in New York City is the making of desserts and salads by the aid of a new Servel Electrolux gas refrigerator which she regards as one of her most precious posessions.

Servel Refrigerators for Prizes

The P & G White Naphtha Soap Contest, featuring Servel Electrolux refrigerators as prizes, now being conducted over the radio under the sponsorship of Procter and Gamble, in collaboration with Servel, Inc., has been an outstanding promotional activity, according to George S. Jones, Jr., vice-president and general sales manager of the refrigerator company. Three hundred Servel Electrolux refrigerators were offered as prizes in the contest which began May 20 to last throughout the present month.

It is claimed that much of the success of the contest in the urban areas has been due to two main factors: first, the cooperation of gas utility sales managers and salesmen in stimulating local interest in the contest; and second, the growing public acceptance of gas refrigeration which helped to create enthusiasm for the contest on the part of the millions of gas company customers who have entered the competition.

South Atlantic News Items

FLORENCE, S. C.—The position of Maitland S. Chase, Jr., who recently resigned as manager of the Sumter, S. C., plant of the Consolidated Gas Company, has been filled by the appointment of Edwin Fulton, formerly manager of the company's Greenwood, S. C., plant. Mr. Fulton's position has been filled by John F. Crawford, of Greenville.

MIAMI, Fla.—A voluntary reduction in rates on gas is being made, effective on June 1st, by the People's Water and Gas Company here. Rates will be reduced from $1.75 to $1.60 per thousand cubic feet where between 5,000 and 25,000 cubic feet are used per month, and from $1.60 to $1.45 per thousand cubic feet where more than 25,000 cubic feet are used per month. It is the sixth voluntary rate reduction to be made by the company.

MIAMI BEACH, Fla.—The city council of Miami Beach has adopted an ordinance regulating the installation of gas appliances. The ordinance provides for an examination for all master and journeymen gas fitters, and imposes an annual license fee of $10.00 for master and $5.00 for journeymen gas fitters.

New Gas Holder Contract for Koppers

Koppers Company's Western Gas Division has just been awarded two construction contracts by the Sinclair Refining Company, New York, N. Y., for their East Chicago, Ind., refinery.

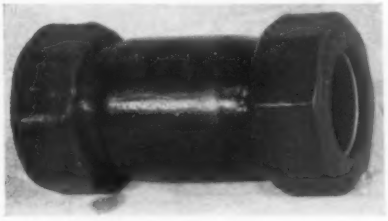
The contracts are for a riveted and weld-caulked, water sealed gas holder with a capacity of 750,000 cubic feet, a sweating tank, 25 feet in diameter and 18 feet high, three open-top rundown tanks, 26 by 10 by 8 feet, and two hot water tanks 12 feet high and 8 feet 6 inches square. The tanks are to be of all welded steel.

The gas holder will be completed in October and the tanks in August.

Dresser Announces New Super Service Fittings

Coming to the aid of gas companies in their perpetual war against leaks and breaks in service lines, S. R. Dresser Manufacturing Company, Bradford, Pa., announces a new line of Super Service Fittings.

Outstanding features, based, according to the manufacturer's announcement, on what research showed gas men wanted in a service fitting, are: extra-heavy construction; use of wedge-shaped gaskets similar to those employed in the Dresser Bolted Couplings, Style 38; reserve sealing power for quickly making tight joints on undersize or corroded pipe; easy assembly on pipe already deflected; "stab" fit that makes disassembly prior to installation unnecessary.



New Dresser Fitting

The basic principle of the new fittings is like that of Dresser's Bolted Couplings, except that threaded end-nuts, screwing up on a threaded body, are used instead of bolts to compress the resilient gaskets tightly around the pipe, effectively sealing the joint.

Its flexibility is said to be an important advantage. Surveys had revealed that many of the leaks in services resulted from rigid connections, which did not absorb frost-heave, expansion or contraction, traffic shock, vibration, soil settlement or shifting, careless back-filling of foreign services, etc.

By the use of the new Super Service Fittings, a constant, positive flexibility is maintained that permits services to "ride" with and absorb all normal pipe movements, whether in the service or in the main, thus preventing failures. This flexibility has been positively proved in the laboratory, where 694,583 continuous pipe deflections were made in a coupling of this type at a pressure of 125 pounds per square inch, through an arc of 4° without pressure drop.

Other advantages are: plain-end pipe only required—no threadings; pipe-ends have full strength—no reduced wall thickness necessary; one jointing tool only—a pipe wrench; anyone can install, even under water if required; safety is inherent; exact pipe lengths, tedious lining-up operations, large excavations are eliminated; a union-type connection is afforded; fittings can be salvaged; and an economical joint is provided.

These fittings are manufactured in a complete line of regular and long couplings, 45° and 90° regular ells, plain-end and threaded-end 90° street ells, and street tees; sizes: ¾" ID to 2" ID inclusive.

Lincoln Electric Appoints Chapple Manager of New Australian Company

The Lincoln Electric Company, manufacturer of arc welding equipment, Cleveland, Ohio, announces the appointment of J. M. Chapple as managing director of the new manufacturing subsidiary, Lincoln Electric Company (Australia) Pty., Ltd., recently established at Alexandria, (Sydney) Australia, by J. F. Lincoln, president of the company. A factory building has been purchased which will manufacture arc welding machines, electrodes and accessories. Mr. Chapple will be in charge of manufacturing, sales and advertising of the new company.

Although a newcomer to The Lincoln Electric Company, Mr. Chapple is a veteran in the welding industry, particularly abroad. For 13 years he has been associated with Armco International Corp., most of that time in foreign service. As welding development engineer, he installed equipment and developed the sales organization of the highly successful joint Armco International-Lincoln Electric arc welding electrode factory in Buenos Aires, Argentina. His experience in this work, plus previous training in every department of the American Rolling Mill Company plant at Middletown, Ohio, fits him remarkably well for the organizational and developmental phases of his new position.

INDUSTRIAL GAS BOILERS

Tubular or Flueless

¾ to 45 H.P.

P. M. LATTNER MFG. COMPANY

CEDAR RAPIDS, IOWA

New Gas-Fired Steam and Hot Water Boiler

A new gas-fired boiler has just been put on the market by York Ice Machinery Corporation of York, Pa., for the residential field. It will be followed shortly by additional lines to reach this market. The complete line of heating and winter air conditioning equipment will be known as "Yorkaire Heat."

York Gas Fired Boiler

The gas-fired boiler shown herewith is available in eight sizes. The hot water boiler will have capacities from 275 to 960 feet of standing cast-iron radiation; and the steam boilers from 250 to 620 feet of standing cast-iron radiation.

The boiler is designed exclusively for gas. The entire mechanism, including atmospheric type gas burners and controls, is fully enclosed. It is completely automatic.

Jay C. Roberson Called by Death

Jay C. Roberson, superintendent, New Brunswick District Gas Distribution Department of Public Service Electric & Gas Co., died suddenly May 11 from a heart attack at the age of 51.

Mr. Roberson started with the company as a cadet engineer, April 1, 1909, and upon completing his cadet training course was appointed foreman, South Amboy Gas Distribution Department. In 1912 he was promoted to general foreman, Plainfield District, and in 1913 was made superintendent, New Brunswick District, which position he held until he died.

Stimulate Range and Water Heater Sales

Two Books By
Charles W. Merriam Jr.

Handy informative volumes written in practical language, giving authoritative facts and figures in an entertaining way on gas water heaters and ranges. They treat of heating fundamentals and all details of appliance operation. A real source of "PEP" for every salesman.

DOMESTIC GAS RANGES

A reference book of great value to every range salesman and for sales department study and discussion groups.

CONTENTS

- Relative Merits of cooking equipment using different fuels
- Types of Ranges
- Console vs. Table Top
- Construction Materials
- Oven Types
- Temperature Control
- Insulation
- Automatic Oven Lighting
- Types of Burners
- Comparative Efficiencies
- Flexible Control
- Fuel Economy
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Renown Stove Co. Announces Appointment of W. G. Shanely

Announcement was recently made by B. A. Nagelvoort, General Manager of the Renown Stove Company, Owosso, Michigan, of a rearrangement of Renown's seaboard sales district, to become effective at once.

Wm. G. Shanely of Reading, Pa., former Manager and Director of Sales for the Mt. Penn Stove Works, Reading, Pennsylvania, will have charge of sales in Eastern Pennsylvania, New Jersey, Maryland and Delaware. Shanely is one of the best known stove men in that territory.

Announcement of the appointment of Paul S. Cecil, of Columbus, Ohio, as Control Engineer was also made.

Cecil was formerly connected with the White-Orr Company of Columbus, Ohio, and with Servel, Inc., of Evansville, Ind. He will work with Chief Engineer N. F. Heym in the company laboratories and will be in charge of chemistry, metallurgy and sand testing.

York Ice Machinery Co. Enters Residential Field

Expressing confidence towards increased business activity this summer, S. E. Lauer, vice-president and general sales manager of the York Ice Machinery Corporation, York, Pa., has announced that his firm is adding new units to its line of heating and residential year 'round air conditioning equipment. A gas-fired steam and hot water boiler has now been placed on the market.

A special promotional and advertising campaign will aid in introducing the product to the residential market. The complete line of heating and winter air conditioning equipment will be known as "Yorkaire Heat."

American Stove Radio Program

A new Hollywood chatter program is on the air, featuring Delight Evans, Editor of Screenland Magazine, who, from her personal acquaintanceship with the movie stars, is well qualified to give the latest news about their habits, their hobbies, and their favorite foods.

Although the American Stove Company has been advertising the Magic Chef Gas Range in newspapers and magazines for twenty years, this is the first time the company has been on the air with a thirteen-week series. The program is now being heard on nineteen stations throughout the country, and more stations are being added every day.

In order to bring Hollywood and ranges together, the favorite recipes of Hollywood stars were used. To add further interest to the show and give it individuality, it was decided to build it around a personality.

The American Stove Company reports excellent results so far. Dealers are enthusiastic . . . one utility, in particular, mentioned that after the first broadcast they received 45 requests for Cook Books (Cook Books are offered over the radio), sold one stove as a direct result, and secured six good prospects.

Gas At New York World's Fair

Reviewing the part gas will play in the exposition, Mr. Hugh H. Cuthrell reports 150 gas appliances are now in actual operation on the World's Fair grounds with an average monthly gas consumption of approximately five million cubic feet and that at the present time service extensions have been completed for gas for all purposes in 20 exhibitors' buildings.

Gas will figure in spectacular illumination projects at the Fair, Mr. Cuthrell pointed out, explaining: "There will be three major uses of gas for illumination —street lighting, flares and spectacular fountain displays."

He said present indications are that the total gas sales will be more than twice those for the Century of Progress Exposition in Chicago.

Epoch-making discoveries and inventions upon which the gas industry has been dependent for scientific development will be dramatized in the Gas Building's educational exhibit.

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In the steam-line leading to any steam-driven pump, whether working in oil, other liquid, or gas, the Fulton Constant-Pressure Pump Governor will do just what its name declares. Discharge pressure will be constant. The diaphragm of the governor is connected to the discharge pipe and any variation of pressure there immediately affects the valve by which the speed of the pump is controlled. Both spring-weighted and lever-type governors are offered. Write for Bulletin No. 4096.

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Pressure relief is obtained through a spring-loaded valve which opens when the pressure reaches a predetermined point. Should the water become overheated to 200° F, a fusible disc melts and lets the water escape thereby preventing a further increase in temperature.

The Titan Relief Valve serves as a coupling connected in the line thereby eliminating the necessity and expense of a tee fitting. To replace fusible disc, it is not necessary to disassemble valves or piping in any way.

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(Continued from page 40)

and forming ammonium thiocyanate, which has most interesting properties in the soil sterilization field, since it is a most violent plant poison but later converts to a fertilizer and therefore does not leave the soil in a permanently toxic condition.

These points are mentioned to show that there is still considerable development possible in the coal carbonizing process to even still further lower present typical costs, but such plants require careful planning to fit their resultant markets of by-products.

Another type of gas generation that would seem to give promise of cheap gas production is a plant that takes cheap crude oil and upgrades it into motor fuels and gas. Such plants as described by L. J. Willien (in the 1937 Production Conference of the A.G.A. entitled "Proposed Combination of Blue Gas Production and Oil Cracking Process.").

The only difficulty with such a process is the future of the material from which it starts. Not using coal and when our oil reserves begin to pinch, such a process may not be as favorable as now seems probable. This study, however, has much to commend it, and gives indication of enabling substantial economies to result over the usual water gas operation. Furthermore, the upgrading of oils gives evidence of always being assured a market, while the upgrading of coal at coke plants involves production of coke which, as time goes on, may reach a contracting market, due to the advancement made in automatic fuels, such as gas and oil. Therefore, this suggested combination of Mr. Willien's has much to cause it to be worthy of careful analysis and study.

It is difficult to become enthusiastic in this country on any process of low temperature carbonization, because of the relatively inferior quality of the resultant coke. In other words, there is no particular upgrading taking place and therefore nothing to carry part of the burden of gasification.

The use of cheap oxygen for blasting a producer has long been held as a possible means for producing cheap gas and has intrigued the fancy of many an engineer. However, when all is said and done, the plan has little to offer, since a careful analysis will reveal that a modern blue gas set does everything that a combination oxygen plant and oxygen producer accomplishes, and does so with approximately similar efficiency and considerably less investment. The reason for this is because both processes merely get rid of the diluting nitrogen in the air used for gasification. The only advantage of the oxygen producer is its continuous operation, as contrasted with intermittent operation of the blue gas set, but it gains this advantage at the expense of an oxygen plant which is a pretty excessive freight charge for a minor point. Unless oxygen can be obtained for from 5c to 7c per M. the process has no saving.

When it comes to considering complete gasification a modern blue gas set with waste heat boilers is a remarkably efficient process, though as mentioned earlier it never will produce a gaseous B.t.u. cheaper than coal.

Enriching mediums for the various complete gasification processes such as water gas sets, and blue gas sets for many years will be available from unused hydrocarbons of the oil industry, though it is difficult to see how any cheaper conditions for those materials, than we now enjoy, will result in the future. In fact, the probabilities are to the contrary. However, when these materials increase, the gas industry can go more and more to the conversion of a B.t.u. from coal, and enriching by the recently developed synthetic catalytic process described at length in Page 470 of Nov. 10, 1937 issue of the British Gas Journal, covering the report of the 41st Research Committee of the Institution & Leeds University. The paper covers the syntheses of hydrocarbons at high pressure and certainly will be food for thought, just as soon as an oil enriching B.t.u. starts to increase in price.

Therefore we in the gas industry may rest assured that we won't have to go very far away from the value of coal to produce our B.t.u. and in some cases, by cooperation in the upgrading of solid fuels or oils may make remarkably cheap B.t.u. that can approach the value of coal. In other words it would seem that our competitive position with coal and other fuels should improve, if anything, and not get worse.

Gas Market Economics:

One thing that seems to brighten our picture is the recently developed polymerization of liquefied gas to motor fuels which is going to tend to reduce the dumping of these liquefied gases into our logical markets at low prices, which a few years ago threatened to swallow so much of our industrial market.

In the water heating market an analysis indicates a tremendous field ahead, as this market has only been scratched among the low income groups. Furnace coils, and jackpots with all their drawbacks are still the general method of heating water, and yet tests carried out at the Massachusetts Institute of Technology show that with modern automatic water heaters, under average manufactured gas rates, the same amount of water can be heated for approximately the same fuel cost as a furnace coil or jackpot. All we need to do is to get the public conscious of the fact that furnace coils and jackpots are not good economy and we can unlock a new market which will double our existing markets. This market will yield very profitable returns and will have very desirable load characteristics.

One other study recently made, that is worthy of consideration, is that of the 1936 A.G.A. Committee on "Economics of Gas House Heating." This study contains a great deal of valuable data and showed that, in general, the gas distribution systems of the country have a tremendous undeveloped capacity and that substantial amounts of house heating can be taken on the average typical distribution system with very little additional investment.

Trends of the Manufactured Gas Industry

If all the above is true, some may well question why the various data showing such disturbing decreases in our output, which has been used by many financial investigators to forecast the impending doom of our manufactured gas industry.

We must bear in mind that the manufactured gas industry is supplying a relatively saturated cooking market in a country approaching a stationary population. Gas has been the universal fuel for cooking and our new customers have not, except to a negligible degree, come from extensions into new territory or the development of rural territory. Such new customers as we have gotten have been largely the result of expansion of those who doubled up in the rigors of the depression. In other words, they are not new customers, but old ones in new locations and in their former houses used gas for cooking and water heating. In the case of electricity usually line extensions into new territory or a new refrigerator or a new radio is brand new load, while gas loads are apt to be merely transferred load.

Furthermore, sales on a per customer basis give a false interpretation because many manufactured

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properties have gone to higher thermal value gases—800 B.t.u. etc., such as St. Louis, Chicago, Washington, Binghamton, Syracuse, etc., which on MCF per meter basis leads to incorrect and unfavorable conclusions.

Therefore, to perhaps analyze a little closer and to try to overcome both of the objections mentioned above, it may be found interesting to look over the monthly figures showing the gas used by various classifications in the manufactured gas industry, as shown in the monthly bulletin gotten out by the A.G.A. These figures are self-corrective in that if a company this year has been converted to natural gas, the figures used as a comparison for the previous year have been put in their proper location.

We must bear in mind that the gas industry already is a heavy purveyor of energy and in actual energy units is delivering some 10 times as much as the electric industry delivers to a domestic consumer. Therefore, to show a 10% increase, we must add as much load as would be equivalent to a 100% increase in the electric load. In other words, it is much harder for us to show the same percentage of increase.

	Total Manufactured Gas Sales		Revenue	
1934	+5.8%	Increase	1.0%	Increase
1935	+3.6%	"	—0.1%	"
1936	+6.6%	"	1.7%	"
1937	+4.0%	"	1.2%	"

The preceding table is quite contrary to our general impression and is indicative of a pretty healthy rate of increase for the entire load. However, let us break this down and analyze the component parts.

	Manufactured Gas *House Htg. Sales*		*Revenue*		Manufactured Gas *Commercial & Ind. Sales*		*Revenue*	
1934	42.6%	Increase	33.5%	Increase	18.0%	Increase	5.0%	Increase
1935	24.1%	"	20.0%	"	12.6%	"	3.8%	"
1936	22.0%	"	16.8%	"	20.7%	"	11.7%	"
1937*	11.0%	"	9.2%	"	11.1%	"	4.5%	"

Both of the above, especially when considering the mild 1937 winter are indicative of a very healthy and steady increase.

Now let us analyze that phase which we have assumed to be the sickest as well as the backbone of the industry, namely, the domestic market.

Domestic Manufactured Gas

	Sales		*Revenue*	
1934	—1.0%	Increase	—1.4%	Increase
1935	—2.4%	"	—2.3%	"
1936	—1.6%	"	—2.0%	"
1937	—1.1%	"	—0.5%	"

* Mild Winter.

The smallness of these decreases, in spite of our usual feeling, is the first fact that attracts attention. Then we notice that the last 3 years show each year a progressive reduction in this decrease. And then when we analyze Table I for the domestic gas for the year 1937, we find that for the last 9 months the domestic gas has shown a steady, though slight, increase, with the exception of two months.

Table I

Manufactured Domestic Gas Percent Increase

	1934	*1935*	*1936*	*1937*
Jan.	—2.2%	—4.5%	0.9%	—3.3%
Feb.	2.0	—6.2	3.4	—9.6
March	1.4	—8.9	1.0	—2.5
April	—2.0	—4.4	0.2	0.5
May	—1.1	—1.1	—1.6	—2.4
June	—0.7	1.0	—4.2	0.3
July	—2.3	1.7	—1.8	1.3
Aug.	—2.3	—0.9	—3.1	1.5
Sept.	1.5	—1.5	—5.9	1.1
Oct.	—0.7	—0.6	—1.4	.3
Nov.	—1.8	—1.0	—2.8	—1.7
Dec.	—3.7	—0.7	—1.7	2.7
Total. Increase	1.0%	—2.4	—1.6	—1.1
Total Year Revenue	1.4%	—2.3	—2.0	—0.5

Further study of the domestic gas figures given in Table I shows that except during the cold first few months of the 1935-1936 winter, since June 1937 is the first sustained period of the domestic load that shows an increase. The month by month domestic figures up to June 1937 show a consistent and regular downward trend, and since then a sustained increase. May this not then be rightly viewed as an indication of the turning point. Certainly it will be interesting to follow as times goes on.

As to market possibilities for our product, some recent figures given out by Dr. Daniel Starch, as a result of his survey, read as follows:

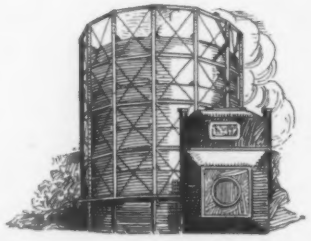
(a) There is a market for 1,000,000 house heating customers in manufactured gas territory and 700,000 in natural gas territory, after making reasonable allowances for mild climate, low buying power and oil burner use, which would provide an additional revenue of $202,500,000.

(b) There is a market for 1,625,000 gas refrigerators after making allowance for buying power and present saturation of automatic refrigeration, which would add $24,000,000 of revenue.

(c) There is a market for 3,260,000 automatic gas water heaters after making allowance for economic factors, opportunity and present saturation with another $57,000,000 of revenue.

The above totals nearly $300,000,000 in the domestic field alone over and above the present $770,000,000 or a 40% increase. What industry would not celebrate and get busy, if its market were only two-thirds saturated.

It must be kept in mind however, that this enormous potential market for our service lies in a highly competitive field and for that reason, in order to carry out our objective, we must be alert, we must be resourceful, we must be sincere salesmen and we must, to a greater extent, be more original particularly in our advertising and in our design of utilization equipment.



P. H. McCance Elected V. P. of Philadelphia Co. of Pittsburgh

Frank R. Phillips, President of the Philadelphia Company and Subsidiary Companies, recently announced the election of Pressley H. McCance as Vice President of the Philadelphia Company. Mr. McCance, a native Pittsburgher who was formerly Assistant to the President and Director of Personnel, has a record of many years of service with the company. His first position was in the Law Department where he started in December of 1923. In 1937 he was named Assistant to the President.

Howard L. Donaldson has been appointed Director of Personnel for the Philadelphia Company and Subsidiary Companies, which appointment went into effect May 1st.

Mr. Donaldson, who has been Manager of the Employment and Training Division of the Personnel Department, has many years' service with the Company.

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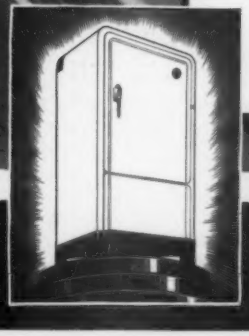

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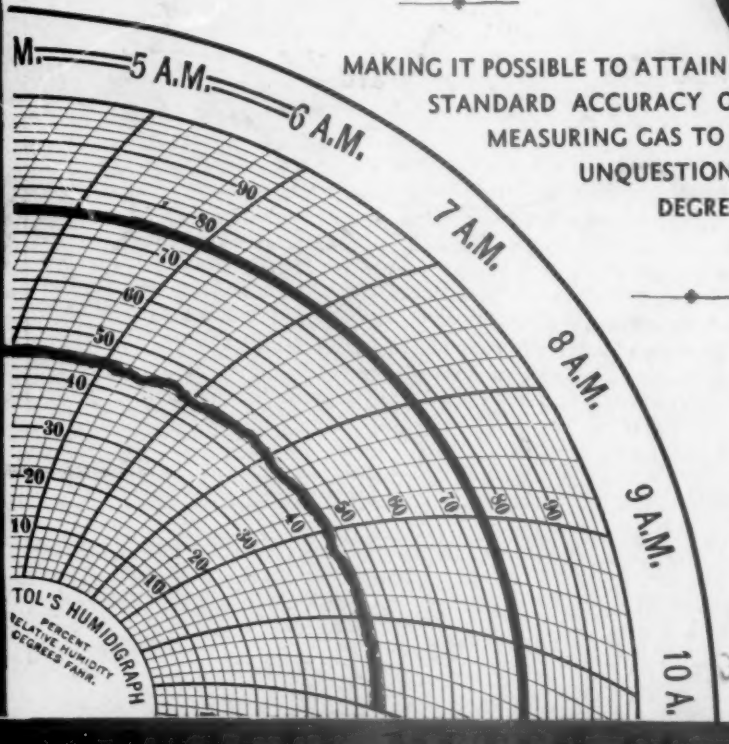

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